

NGM.COM MAY 2011

NATIONAL GEOGRAPHIC

ABOVE

Yosemite

Like Never Before

- Australia's Great Barrier Reef 34
- Unsinkable Spirit of Bangladesh 58
- Why Weaver Ants Rule the Forest 84
- The Magic of Camera Obscura 118
- Happy Hour at the Ochroma Tree 130

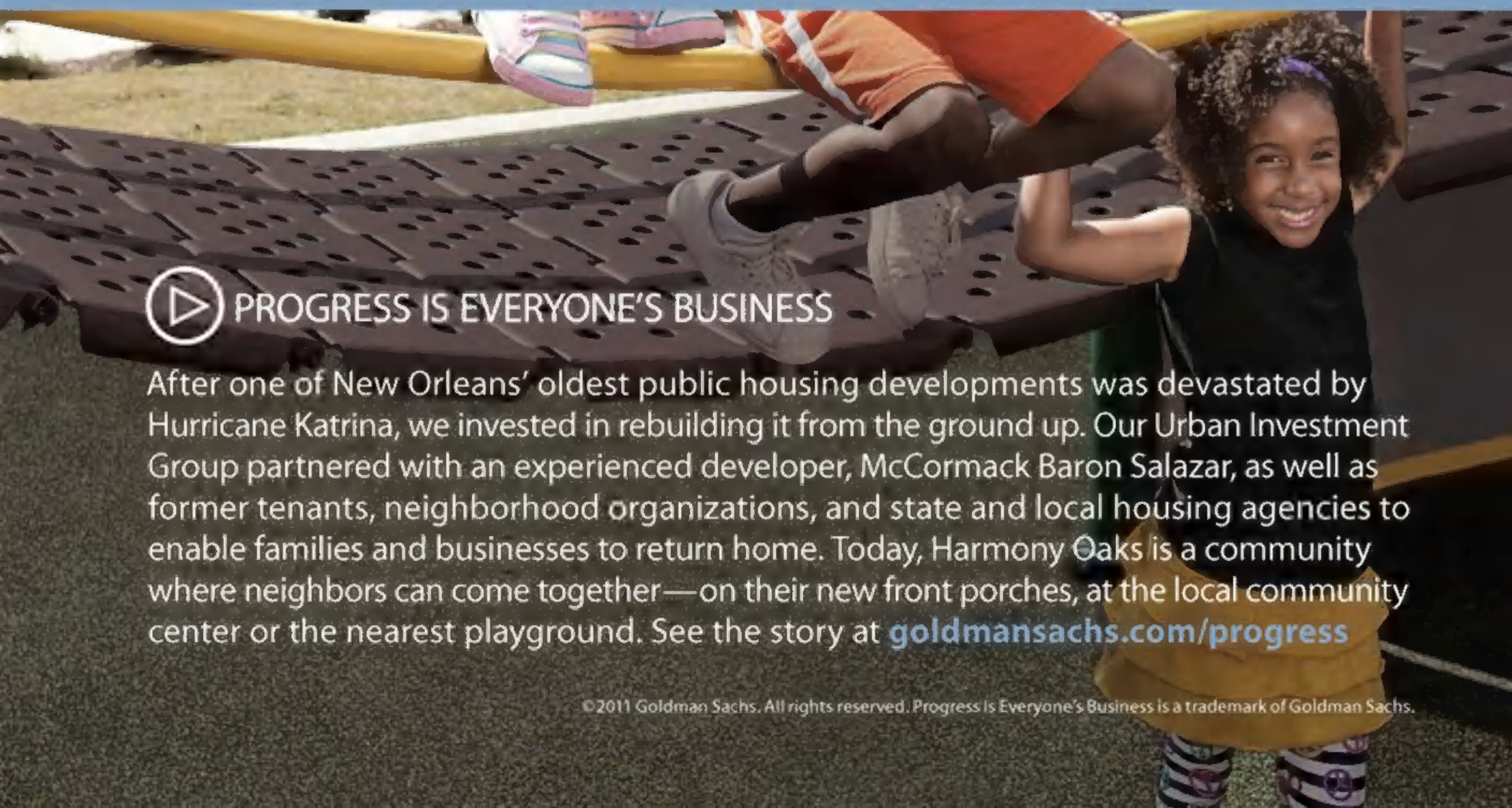


HOW AN INVESTMENT IN A HOUSING DEVELOPMENT





IS REBUILDING AN ENTIRE COMMUNITY IN NEW ORLEANS



PROGRESS IS EVERYONE'S BUSINESS

After one of New Orleans' oldest public housing developments was devastated by Hurricane Katrina, we invested in rebuilding it from the ground up. Our Urban Investment Group partnered with an experienced developer, McCormack Baron Salazar, as well as former tenants, neighborhood organizations, and state and local housing agencies to enable families and businesses to return home. Today, Harmony Oaks is a community where neighbors can come together—on their new front porches, at the local community center or the nearest playground. See the story at goldmansachs.com/progress



Gopher Tortoise (*Gopherus polyphemus*)

Size: Carapace length, 20 - 30 cm (7.9 - 11.8 inches) **Weight:** 2 - 6 kg (4.4 - 13.2 lbs)

Habitat: Southeastern United States; prefers habitats with well-drained, sandy soil, including longleaf pine forests **Surviving number:** Unknown; populations declining



Photographed by Joel Sartore

WILDLIFE AS CANON SEES IT

A born burrower. The gopher tortoise is endowed with shovel-like front feet that allow it to dig burrows nearly 40 feet in length with relative ease. These underground lairs provide shelter from forest fires and offer hatchlings some protection from the many predators that would like to make them a meal. Other animals use the tortoise's burrows as well, sometimes—but not always—waiting until the tortoise has abandoned them. In fact, these burrows

are so important to the overall ecosystem that the gopher tortoise is considered a keystone species. If its habitat continues to fragment and shrink, however, its burrowing days may well be numbered.

As we see it, we can help make the world a better place. Raising awareness of endangered species is just one of the ways we at Canon are taking action—for the good of the planet we call home. Visit canon.com/environment to learn more.

Canon

NATIONAL GEOGRAPHIC

MAY 2011 • VOL. 219 • NO. 5

- The Reef's Greatest Test** 34 Australia's Great Barrier Reef faces unprecedented change.
By Jennifer S. Holland Photographs by David Doubilet
- Buoyant in Bangladesh** 58 Its resourceful residents refuse to give in to rising seas.
By Don Belt Photographs by Jonas Bendiksen
- Sisterhood of Weaver Ants** 84 They swarm in forest canopies, sew leaves, share scents.
By Douglas H. Chadwick Photographs by Mark W. Moffett
- Yosemite's Superclimbers** 98 They're hanging on by a fingertip—without a rope.
By Mark Jenkins Photographs by Jimmy Chin
- Bravura Camera Obscura** 118 A hole in a black plastic sheet creates magical images.
By Tom O'Neill Photographs by Abelardo Morell
- Happy Hour in a Tree** 130 The *Ochroma* serves nightly snacks for monkeys, birds, bugs.
By Natalie Angier Photographs by Christian Ziegler



Scientists bleach coral—like this piece of *Seriatopora hystrix*—to preserve the skeleton for study. In the wild, coral bleaching, caused mainly by rising temperatures, imperils reefs. Story on page 34.

PHOTO: DAVID DOUBILET

The system is not a substitute for your own visual assessment before changing lanes. System accuracy may vary based on weather, size of object and speed. Learn more at acura.com or by calling 1-800-To-Acura. ©2011 Acura. Acura and TL are registered trademarks of Honda Motor Co., Ltd.





Aggression in its most elegant form.

With a 6-speed automatic transmission and available 305-hp engine, it's aggressive. But with an Advance Package that includes ventilated front seats and a blind spot information system, it's also refined. The 2012 Acura TL – elegance with an edge.*

NATIONAL GEOGRAPHIC

DEPARTMENTS



Editor's Note 4

National Geographic on TV 6

Letters 10

Your Shot 12

Visions of Earth 14

FOSSILS

An Unexpected Penguin Hue

A 36-million-year-old find—complete with feathers—reveals a reddish brown coat.

HEALTH

Mark of Youth

Having many moles could mean fewer wrinkles and stronger bones.



WILD

Mishmash Fish

It has a snout like an elephant's, fins like a ray's—and is a cousin to the shark.

POPULATION

Bunny Crop

There will soon be seven billion humans. How does that compare to animal numbers?

CONSERVATION

Protecting Polar Bears

Setting aside critical habitat in Alaska could help. Oil interests aren't fans of the plan.



THE BIG IDEA

Great Tree Survey 30

A new way of measuring the carbon in forests may help keep them from being cut down.



Inside Geographic 144

Flashback

On the Cover

Many climbers crawl along Yosemite's Thank God Ledge on Half Dome. Alex Honnold walks face out because "that's cooler."

Photo by Jimmy Chin

ngm.com



Schooled in Rocks

Videos take you into the world of extreme climbers. Dean Potter admires Yosemite's "amazing energy" as he walks a highline over a waterfall. Note: He swears he's not a "lunatic."

JIMMY CHIN



HOMEOWNERS INSURANCE. NOW AVAILABLE AT YOUR FAVORITE ONLINE INSURANCE STORE. Homeowners insurance from Progressive is one more way to get the kind of savings you expect from us. Plus, you can save even more when you bundle your home and auto policies. Saving you time and money. Now that's Progressive.

1-800-PROGRESSIVE / PROGRESSIVE.COM

PROGRESSIVE

Homeowners insurance underwritten by Homesite Group Incorporated, Boston, MA, IDS Property Casualty Co., DePere, WI, and ASI Loyds, St. Petersburg, FL, and their affiliates, who are not affiliated with Progressive and are solely responsible for claims. Not available in AK and FL. Auto insurance underwritten by Progressive Casualty Ins. Co. & its affiliates, Mayfield Village, OH. Auto insurance prices and products are different when purchased directly from Progressive or through independent agents/brokers. Bundling discount not available in all states. 11D00067.NG (03/11)

EDITOR'S NOTE

Photo editors are the behind-the-scenes heroes of a photographer's work. The editor sees every single frame and picks up on every mistake and missed opportunity. Then he or she uses everything at hand to correct, coach, and inspire.

David L. Arnold was the best of the best. He was not easy to please, but I trusted his judgment, even when his criticism was tough to hear. When he told me I'd made a memorable photograph, I trusted that too.

One of those memorable photographs was of a honeycreeper, a beautiful bird native to the forests of Hawaii. I'd spent five days on a tiny platform 30 feet off the ground waiting for that bird. I was cold and wet. The tree I sat in swayed alarmingly. The photo I finally made wasn't good enough, David gently told me. He encouraged me to go back and do better, supporting my obsession to get it right. I repaid his support with a photograph of the bird that ran on the September 1995 cover.

David died a few months ago. He'd retired from the magazine in 1994 after 27 years of inspiring photographers. But his spirit can still be seen and felt. He was a role model for Kathy Moran, who photo edited this month's story on the Great Barrier Reef. "I learned from David to be honest with photographers at all cost," she says. "I learned that to edit a story you need to know the subject thoroughly. David always did his homework. He had a Ph.D. in every story he worked on."

David pushed photographers to think about how best to tell the story. He had an unshakable belief in excellence. These are lessons I have taken to heart. I would not be Editor in Chief of this magazine if I had not worked with him.







A photographer as well as a photo editor, David Arnold traveled to Alaska for a story in October 1977.



Some places give you a welcome packet. We give you a welcome person.

SCHWAB'S NEW CLIENT CONCIERGE makes you feel at home in no time. At no extra cost, you get your own dedicated person for:

-  **HELP WITH THE PAPERWORK**
-  **HELP WITH THE ASSET TRANSFER PROCESS**
-  **ANSWERING YOUR QUESTIONS**
-  **WALKING YOU THROUGH SCHWAB.COM**

Talk to Chuck about switching today.
Visit your local branch, call 1-800-4SCHWAB
or go to schwab.com



charles SCHWAB



“Humans and sharks are interacting much more frequently than they think. Than the people think, anyway.”

—Captain Brett McBride

Shark Men | Sundays at 10 p.m. ET/PT beginning in April

Shark Men

Last season expert angler Chris Fischer and his team caught and released great white sharks—including one that was nearly 17 feet long. The detailed scientific data they gathered helped them better understand the breeding and eating habits of these mysterious predators,



whose habitats are threatened. This season the team goes back

for a bigger sample size to find out even more. Watch the story unfold in the returning series, airing Sundays at 10 p.m. ET/PT beginning in April on the National Geographic Channel.



Taboo
May 2, 9 & 10 p.m. ET/PT

In *Forbidden Love* “object of affection” gains new meaning. (Airs Mondays at 10 p.m. after May 2.)



Area 51 Declassified
May 22, 10 p.m. ET/PT

Men who worked at the notorious Nevada military base share stories for the first time.

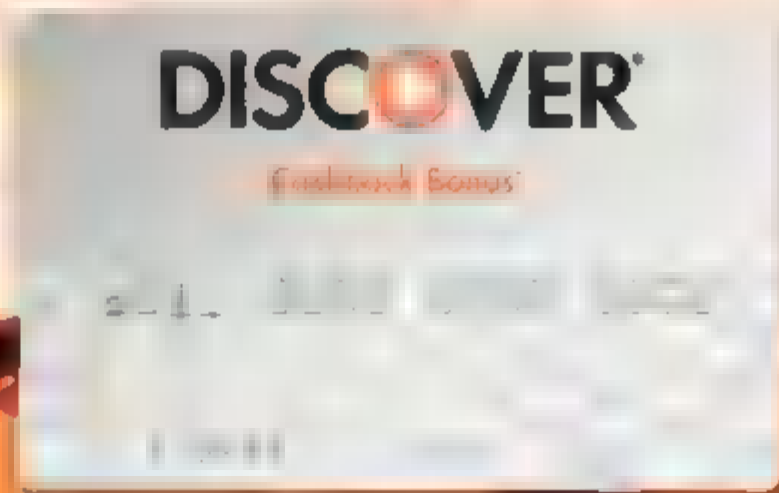
For a full schedule of listings go to natgeotv.com.

We are proud to have America's

#1 cash rewards program.*

Because when you're talking about rewards, who wants the #2 program?

It pays to switch. It pays to



1-866-DISCOVER
discover.com



Inspiring people to care about the planet

The National Geographic Society is chartered in Washington, D.C., as a nonprofit scientific and educational organization "for the increase and diffusion of geographic knowledge." Since 1888 the Society has supported more than 9,000 explorations and research projects, adding to knowledge of earth, sea, and sky.

NATIONAL GEOGRAPHIC MAGAZINE

EDITOR IN CHIEF **Chris Johns**

DEPUTY EDITOR: Victoria Pope

CREATIVE DIRECTOR: Bill Marr

EXECUTIVE EDITORS

Dennis R. Dimick (*Environment*), David Griffin (*E-Publishing*),

Kurt Mutchler (*Photography*), Jamie Shreeve (*Science*)

MANAGING EDITOR: Lesley B. Rogers

NGM.COM: Rob Covey

TEXT **DEPUTY DIRECTOR:** Marc Silver **STORY DEVELOPMENT EDITOR:** Barbara Paulsen **ARTICLES EDITOR:** Oliver Payne

SENIOR EDITORS: Lynn Addison (*Features*), Robert Kunzig (*Environment*), Peter Miller (*Expeditions*), **EDITOR AT LARGE:** Cathy Newman **FEATURES EDITORS:** Glenn Oeland, Jane Vessels

EDITOR, MISSION PROJECTS: Hannah Bloch **ASSISTANT EDITOR:** Amanda B. Fiegl

SENIOR WRITERS: Jennifer S. Holland, Tom O'Neill, A. R. Williams, **WRITER:** Peter Gwin

ADMINISTRATION: Imad Adun, Katia Andreassi, Nicholas Mott

CONTRIBUTING WRITERS: Caidline Alexander, Don Bell, Joel K. Bourne, Jr., Robert Draper, Cynthia Gorney, Peter Hessler, Mark Jenkins, David Quammen

DEPARTMENTS DIRECTOR: Margaret G. Zackowitz

DEPUTY DIRECTOR: Luna Shtyl **EDITOR:** Jeremy Berlin **ADMINISTRATION:** Catherine Zuckerman

COPYDESK DIRECTOR: David Brindley

SENIOR COPY EDITOR: Mary Beth Oetkers-Keegan **COPY EDITOR:** Kitry Krause

PRODUCTION: Sandra Dane **SCHEDULING DIRECTOR:** Carol L. Dumont

PHOTOGRAPHY **DEPUTY DIRECTOR:** Ken Geiger

SENIOR EDITORS: Bill Douthett (*Special Editions*), Kathy Moran (*Natural History*),

Susan Welchman (*Departments*), **EDITOR AT LARGE:** Michael Nichols

SENIOR PHOTO EDITORS: Alice Gabriner, Kim Hubbard, Todd James, Elizabeth Krist, Sarah Leen,

Sadie Quamer, **PHOTO EDITOR/SPECIALIST:** Deirdre Read **RESEARCH EDITOR:** Mary McPeak

STAFF PHOTOGRAPHER: Mark Thiessen **STUDIO:** Rebecca Hale **DIGITAL IMAGING:** Edward Samuel,

Evan Wilder **PHOTO ENGINEERING:** Walter Boggs, David Mathews, Ken Yamaguchi

RIGHTS MANAGER: Elizabeth Grady **ADMINISTRATION:** Whitney Hall, Sherry L. Brubacher,

Kate Napier, Elena Shevko, Casten Wills

DESIGN/ART **DESIGN DIRECTOR:** David C. Whitmore **ART DIRECTOR:** Juan Velasco

MAPS DIRECTOR: William E. McNulty

DEPUTY ART DIRECTOR: Kaitlin M. Yarnall **SENIOR DESIGN EDITORS:** John Baxter, Elaine H. Bradley

DESIGN EDITOR: Oliver R. Uberti **SENIOR GRAPHICS EDITORS:** Fernando G. Baptista, Martin

Gamache, Virginia W. Mason, Sean McNaughton, John Tomiano **SENIOR CARTOGRAPHY EDITORS:**

Marguente B. Hunsiker, Gus Platis **CARTOGRAPHY EDITOR:** Lisa R. Ritter **ART RESEARCH EDITOR:**

Amanda Hobbs **GRAPHICS SPECIALISTS:** Jerome N. Cookson, Manel Furlong, Lawson Parker

SENIOR DESIGNER: Betty Clayman DeAtley **DESIGNER:** Hannah Tak

ADMINISTRATION: Cindy Reichard, Michael Kritikos

RESEARCH **DIRECTOR:** Abigail A. Tipton

RESEARCH EDITORS: Alice S. Jones, Kathy B. Maher, Heidi Schultz, Elizabeth Snodgrass,

Christy Ulrich, Barbara L. Wyckoff **SENIOR RESEARCHERS:** Karen C. Font, Nora Gallagher, David

A. Lande, Nancie Majkowski, Taryn Salinas, Brad Scriber **ADMINISTRATION:** Jacqueline Rowe

E-PUBLISHING **DEPUTY DIRECTOR:** Melissa Wiley **SENIOR VIDEO PRODUCER:** Hans Weise

DESIGNER: Lindsay Powell **ADMINISTRATION:** Trish Dorsey

NGM.COM **SENIOR PRODUCERS:** Paul Heltzel, John Kondis **ASSOCIATE PRODUCER:** William Bart

SENIOR PHOTO EDITOR: Monica C. Corcoran **ART DIRECTOR:** Shawn Greene

ADMINISTRATION **Karen Dufort Sligh** (*Asst. to the Editor in Chief*), Valarie Cribb-Chapman (*Finance*); **Nikisha Long**

COMMUNICATIONS VICE PRESIDENTS: Beth Foster, Mary Jeanne Jacobsen; **Barbara S. Moffet**

IMAGE COLLECTION AND SALES VICE PRESIDENT: Maura A. Munnhill; **William D. Perry**

LIBRARIES AND INFORMATION SERVICES DIRECTOR: Barbara Penfold Ferry; **Renee Braden**

PRODUCTION SERVICES **SENIOR VICE PRESIDENT:** Phillip L. Schosser

IMAGING DIRECTOR: Thomas J. Craig; **John Bailay**, David J. Bulebush, Neal Edwards, James P.

Fay, Arthur N. Hondros, Gregory Luce, Ann Marie Pelish, Bernard Quarrick, Stephen L.

Robinson **PRINTING:** Joseph M. Anderson **QUALITY DIRECTOR:** Ronald E. Williamson; **Clayton R.**

Burneston, **Michael G. Lappin**, **William D. Reicherts** **DISTRIBUTION DIRECTOR:** Michael Swarr

INTERNATIONAL EDITIONS **EDITORIAL DIRECTOR:** Amy Kolczak

PHOTO AND DESIGN EDITOR: Darren Smith **PHOTOGRAPHIC LIAISON:** Laura L. Ford

PRODUCTION: Angela Bolzer **ADMINISTRATION:** William Shubert

EDITORS **ARABIC:** Mohamed Al Hammadi

BRAZIL: Matthew Shirts

BULGARIA: Krassimir Drumev

CHINA: Ye Nan

CROATIA: Hrvoje Prčić

CZECHIA: Tomáš Tureček

FRANCE: François Marot

GERMANY: Erwin Brunner

GREECE: Mana Almatziokou

HUNGARY: Tamás Schlosser

INDONESIA: Yunas Santhani Azis

ISRAEL: Daphne Raz

ITALY: Marco Cattaneo

JAPAN: Shigeo Otsuka

KOREA: Sun-ok Nam

LATIN AMERICA: Omar López

LITHUANIA: Frederikas Jansonas

NETHERLANDS/BELGIUM: Aart Aarsbergen

NORDIC COUNTRIES: Karen Gunn

POLAND: Martyna Wojciechowska

PORTUGAL: Gonçalo Pereira

ROMANIA: Cristian Lascu

RUSSIA: Alexander Grek

SERBIA: Igor Bill

SLOVENIA: Manja Javornik

SPAIN: Josep Cabello

TAIWAN: Roger Pan

THAILAND: Kowit Phadungruangkij

TURKEY: Nesibe Bat

ADVERTISING 711 Fifth Avenue, New York, NY, 10022; Phone: 212-610-5500; Fax: 212-610-5505

EXECUTIVE VICE PRESIDENT AND WORLDWIDE PUBLISHER: Claudia Malley

NATIONAL ADVERTISING DIRECTOR: Robert Amberg **VICE PRESIDENT MARKETING:** Jenifer Berman

VICE PRESIDENT BUSINESS AND OPERATIONS: Margaret Schmidt **MANAGER:** Karen Sarris (*Detroit*)

INTERNATIONAL MANAGING DIRECTOR: Charlie Attenborough **DIRECTORS:** Nadine Hegge

(*International*), Rebecca Hill (*Marketing*), David Middis (*British Isles*)

CONSUMER MARKETING VICE PRESIDENT WORLDWIDE: Terrence Day **DIRECTORS:** Christina C.

Alberghini (*Member Services*), Anne Barker (*Renewals*), Richard Brown (*New Business*),

John MacKethan (*Financial Planning and Retail Sales*), John A. Seeley (*International*)

NATIONAL GEOGRAPHIC SOCIETY

CHAIRMAN AND CEO **John M. Fahey, Jr.**

PRESIDENT: Timothy T. Kelly

EXECUTIVE VICE PRESIDENTS

Terrence B. Adamson

PRESIDENT, ENTERPRISES: Linda Betkeley

MISSION PROGRAMS: Terry D. Garcia

COMMUNICATIONS: Betty Hudson

PRO: Christopher A. Liedel

BOARD OF TRUSTEES

Joan Abrahamson, Michael R. Bonsignore, Jean N. Case,

Alexandra Grosvenor Elker, Roger A. Enrico, John M. Fahey, Jr.,

Daniel S. Goldin, Gilbert M. Grosvenor, Timothy T. Kelly,

Maria E. Lagomasino, George Muñoz, Reg Murphy,

Patrick F. Noonan, Peter H. Raven, William K. Reilly,

Edward P. Roski, Jr., James R. Sasser, B. Francis Saul II,

Gerd Schulte-Hillen, Ted Waitt, Tracy R. Wolstencroft

COUNCIL OF ADVISORS

CHAIRMAN: Edward P. Roski, Jr.

Darlene T. Anderson, Lucy C. Billingsley, Michael R.

Bonsignore, Howard G. Bullitt, Virginia Busch,

Jean N. Case, David Court, Roger A. Enrico,

Juliet C. Folger, Robert B. Haas, David H. Koch, Iara Lee,

Sven-Olof Lindblad, Bruce L. Ludwig, Claudia Madrazo

de Hernández, David P. Margulies, Michael L. Matkins,

Larry Mullen, Jr., Sally Engelhard Pingree, W. Russell

Ramsey, Catherine B. Reynolds, Joseph E. Robert, Jr.,

Victoria P. Sanil, B. Francis Saul II, Ted Waitt, Sam R. Walton,

Garry A. Weber, Tracy R. Wolstencroft, William Wrigley, Jr.

RESEARCH AND EXPLORATION COMMITTEE

CHAIRMAN: Peter H. Raven

VICE CHAIRMAN: John M. Francis

Kamaljit S. Bawa, Colin A. Chapman, Keith Clarke,

Steven M. Colman, J. Emmett Duffy, Philip Grogan,

Carol P. Harden, Jonathan B. Losos, John O'Loughlin,

Naomi E. Pierce, Hsa M. Redmond, Thomas B. Smith,

Wirt H. Wills, Melinda A. Zeder

EXPLORERS-IN-RESIDENCE

Robert Ballard, Wade Davis, Jared Diamond,

Sylvia Earle, J. Michael Fay, Zahi Hawass, Beverly

Joubert, Dereck Joubert, Louise Leakey, Meave Leakey,

Johan Renhard, Paul Sereno, Spencer Wells

MISSION PROGRAMS

VICE PRESIDENT, MEDIA OUTREACH: Mark Bauman

VICE PRESIDENT, EDUCATION: Daniel Edelson

VICE PRESIDENT, PCE GRANTS: John M. Francis

CHIEF OPERATING OFFICER: Sarah Laskin

VICE PRESIDENT, PUBLIC PROGRAMS: Gregory A. McGruder

VICE PRESIDENT, STRATEGIC INITIATIVES: Alexander Moon

SR. VICE PRESIDENT, GLOBAL PARTNERSHIPS: Kristin Rechberger

HUMAN RESOURCES SR. VICE PRESIDENT: Thomas A. Sabló

DEVELOPMENT SR. VICE PRESIDENT: Jacqueline M. Hollister

TREASURER: Barbara J. Constantz

CHIEF SUSTAINABILITY OFFICER: Hans H. Wegner

NATIONAL GEOGRAPHIC GLOBAL MEDIA

PRESIDENT: Timothy T. Kelly

CHIEF OPERATING OFFICER: Edward M. Prince, Jr.

PUBLISHING PRESIDENT: Declan Moore

ENTERTAINMENT PRESIDENT: David Beal

DIGITAL MEDIA PRESIDENT: John Caldwell

TELEVISION PRESIDENT: Michael Rosenfeld

NATIONAL GEOGRAPHIC CHANNEL PRESIDENT: David Hastingden

NATIONAL GEOGRAPHIC CHANNEL-U.S. PRESIDENT: Steve Schiffman

NATIONAL GEOGRAPHIC SCHOOL PUBLISHING GROUP

PRESIDENT AND CEO: Alison Wagner

Contributions to the National Geographic Society are tax

deductible under Section 501(c)(3) of the U.S. tax code.

Copyright © 2011 National Geographic Society

All rights reserved. National Geographic and Yellow

Border Registered Trademarks © Marcas Registradas.

National Geographic assumes no responsibility for

unsolicited materials. Printed in U.S.A.

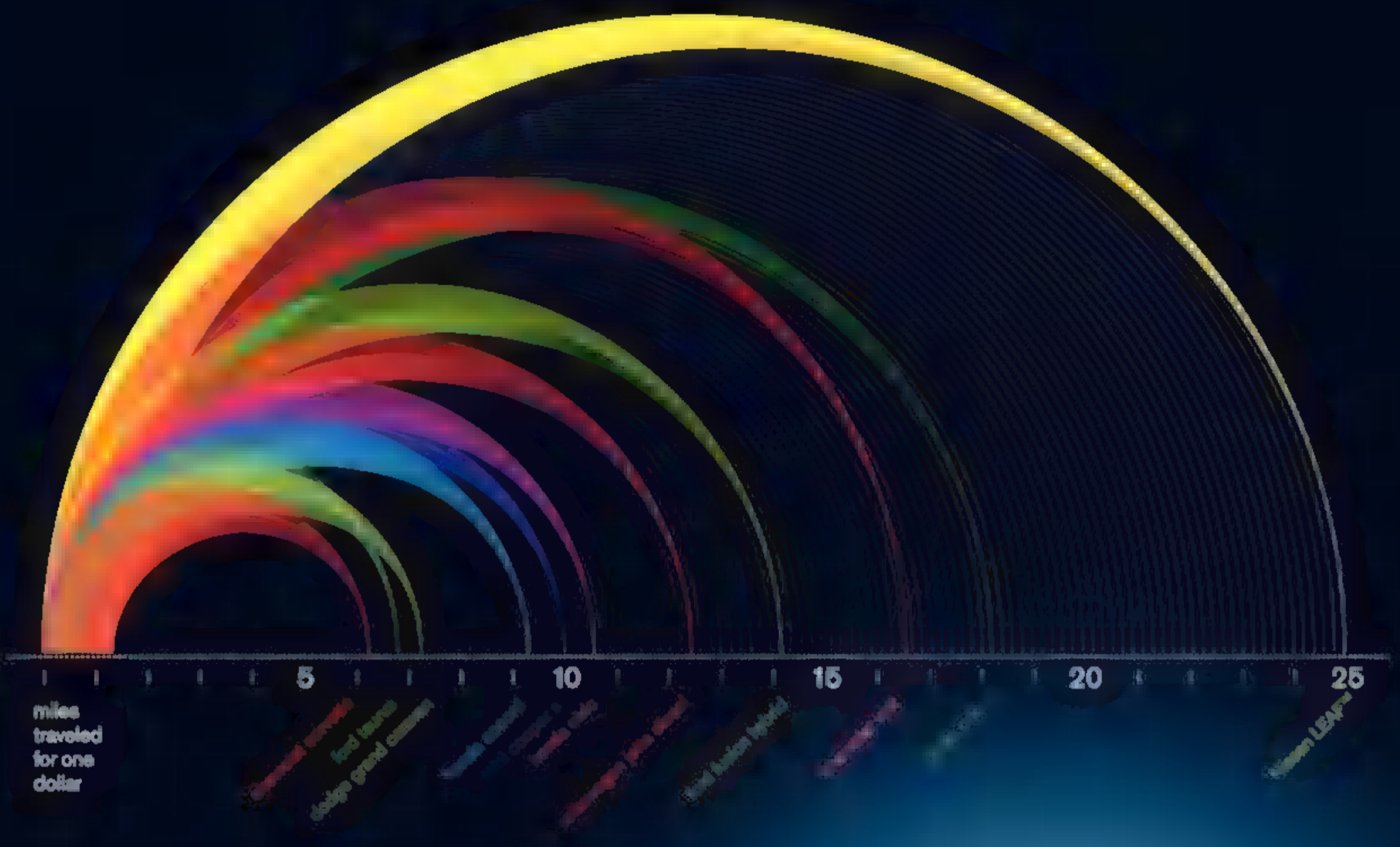


Please recycle.

SHIFT the way you move



NissanUSA.com



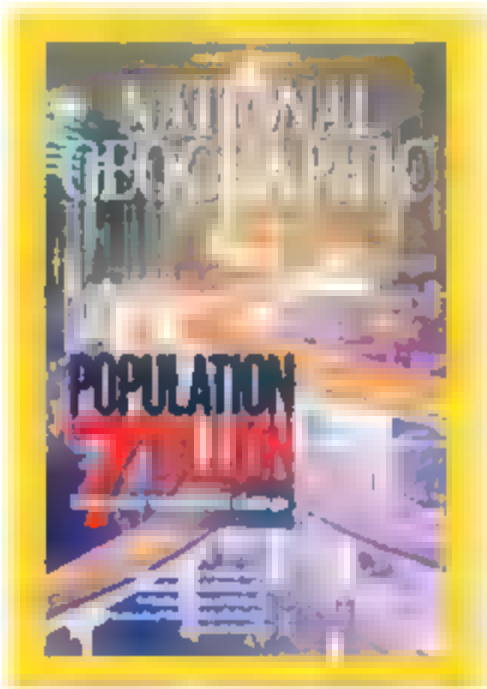
the new mpg

comparing miles per gallon is suddenly irrelevant — the Nissan LEAF™ doesn't even have a gas tank, so let's just compare how far your car can take you on a single dollar. the math speaks for itself.

the 100% electric Nissan LEAF™
innovation for the planet.
innovation for all.



Miles per dollar for gas-powered and hybrid vehicles based on 2011 EPA-estimated combined city and highway miles per gallon and average national cost of regular unleaded gasoline forecasted by Global Insight for 2011. Miles per dollar for LEAF based on EPA 73-mile estimate range and average national cost of \$0.12 cents per kilowatt hour as of December 2010. Based upon US EPA LA4 cycle conducted in laboratory tests. See http://www.fueleconomy.gov/fec/leaf_schedules.shtml. Volt miles per dollar calculated at 35 miles using electricity and 38 miles using gasoline. Gradual loss of capacity in LEAF battery will result with time and use. Actual range will vary depending upon driving/charging habits, speed, conditions, weather, temperature and battery age. All trademarks are registered marks of their respective owners. Always wear your seat belt, and please don't drink and drive. ©2011 Nissan North America, Inc.



January 2011

Population 7 Billion

I was thrilled when I saw that your lead article was focused on human population. I believe that overpopulation is the root cause of many of the planet's problems. I was disturbed when I realized that the message of the article was: "Find out why you shouldn't panic—at least, not yet." From where I sit, it looks like it is definitely time to panic. My perception is that with seven billion of us, we're not living sustainably, and with nine billion it will be even worse.

DAN MARSHALL
Cupertino, California

Regarding population growth and anticipated need for food, fuel, et cetera: Shouldn't worldwide birth control programs be implemented before we destroy the planet? My college biology teacher reminded us that pestilence, famine, and weather disasters used to control populations. Now we try to control these. This has taken away the control of population growth. That leaves government birth control programs as the only means left for saving our world.

MARY ROGERS
San Antonio, Texas

We're all in this together—men and women, old and young, gay and straight, rich and poor, all ethnic groups, and every societal variation. If we can't get a handle on our population issues and attendant challenges, none of us will for long have the luxury of wallowing in our petty differences.

MIKE FULLERTON
Littleton, Colorado

As human nature is not likely to change anytime soon, "me and mine" is probably going to dominate more as population pressures increase on society. This will push out those who don't have. We are not likely to create a more benevolent society that takes care of its elderly population. People want the government to take care of their granny but don't want to pay more to take care of everyone else's granny. I often wonder if people realize that the amount of money a government has is directly proportional to how much it takes in in taxes.

MARC BREMER
Benicia, California

Pages 66-7 of this issue feature a photograph of a suburban housing development near Las Vegas. I've been to Nevada. The state is a near perfect place to collect solar power. And yet the photo, featuring many hundreds of houses, shows virtually none with solar panels on their roofs. This is astounding. All of us are inundated daily with information about global warming, carbon emissions, solar and wind power, et cetera. But this seems to have had no effect on the Las Vegas homeowners or developers

who built these tract houses. Nevada is sun rich. Why doesn't it harvest this immense wealth?

FRED SEIDEN
New York, New York

I have to criticize the optimistic tone of the population article, despite my appreciation that the subject is being addressed. The general outline of the overpopulation crisis has not supported optimism in any way. The outcome is here; the future atrocity is predictable. This topic represents another aspect of the culture war between those who would live with self-serving spiritual myths that reinforce fertility and those who look at the systems of the world clearly and scientifically. It's dishonest to equate the two visions.

SHELLEY OTTENBRITE
Richmond, Virginia

I think *National Geographic* should consider another series (similar to population) on another challenge humans face: war. The history, geography, social and economic impact, and the human species' propensity for war would make fascinating reading. The series could conclude with ideas for preventing future wars.

DAVID OLSEN
Greendale, Wisconsin

Corrections

JANUARY 2011: TIMBUKTU

Page 90: Mali's northern desert was incorrectly described as three times the size of France; it's only slightly larger. France measures 212,935 square miles. The desert is about 27,000 square miles larger.

Email ngsforum@ngm.com

Write National Geographic Magazine, PO Box 98199, Washington, DC 20090-8199. Include name, address, and daytime telephone. Letters may be edited for clarity and length.

"Hey, big brother. Your doctor's talking about plaque in your heart's arteries. And you're just going to turn the page?"

The cholesterol-lowering medicine NIASPAN

- If you have high cholesterol and coronary artery disease, NIASPAN, along with diet and a bile acid-binding resin (another cholesterol medicine), is FDA-approved not only to slow down plaque buildup, but to actually help clear some of it away.

- A low-fat diet and exercise alone may not be enough.

High cholesterol is one risk factor that leads to plaque buildup. Other factors include: family history of early heart disease, high blood pressure, smoking, and diabetes.

NIASPAN, with a bile acid-binding resin, has not been shown to prevent heart disease, heart attacks, or stroke.

IMPORTANT SAFETY INFORMATION

- Prescription NIASPAN should not be taken by people with stomach ulcers, liver or serious bleeding problems. ■ **Severe liver damage can occur when switching to a long-acting niacin, such as NIASPAN, from immediate-release niacin.** ■ Blood tests are needed before and during treatment with NIASPAN to check for liver problems. ■ Contact ■ health care provider if serious side effects such as unexplained muscle pain, tenderness, or weakness develop. The risk of these side effects may be higher when taking NIASPAN with a statin. ■ Tell your health care provider if you have a history of gout, drink large amounts of alcohol, or if you are diabetic and experience increases in blood sugar. ■ The most common side effect of NIASPAN is flushing (warmth, redness, itching, and/or tingling of the skin).

You are encouraged to report negative side effects of prescription drugs to the FDA.

Visit www.fda.gov/medwatch, or call 1-800-FDA-1088 (1-800-332-1088).

If you cannot afford your medication, contact: www.pparx.org or call the toll-free number 1-888-4PPA-NOW (1-888-477-2669) for assistance.

Please see the next page for brief summary of full Prescribing Information.



**START FIGHTING PLAQUE.
ASK YOUR DOCTOR ABOUT NIASPAN.**



Fight Back. Fight Plaque.

www.niaspan.com ■ 1-877-NIASPAN (1-877-642-7726) ■ Text NIASPAN2 to 80800 for more information*

© 2011 Abbott Laboratories Abbott Park, IL 60064 303-566504 March 2011 Printed in U.S.A. *Message and data rates may apply.

INDICATIONS AND USAGE Therapy with lipid-altering agents should be only one component of multiple risk factor intervention in individuals at significantly increased risk for atherosclerotic vascular disease due to hyperlipidemia. Niacin therapy is indicated as an adjunct to diet when the response to a diet restricted in saturated fat and cholesterol and other nonpharmacologic measures alone has been inadequate.

1. NIASPAN is indicated to reduce elevated TC, LDL-C, Apo B and TG levels, and to increase HDL-C in patients with primary hyperlipidemia and mixed dyslipidemia.
2. NIASPAN in combination with simvastatin or lovastatin is indicated for the treatment of primary hyperlipidemia and mixed dyslipidemia when treatment with NIASPAN, simvastatin, or lovastatin monotherapy is considered inadequate.
3. In patients with a history of myocardial infarction and hyperlipidemia, niacin is indicated to reduce the risk of recurrent nonfatal myocardial infarction.
4. In patients with a history of coronary artery disease (CAD) and hyperlipidemia, niacin, in combination with a bile acid binding resin, is indicated to slow progression or promote regression of atherosclerotic disease.

Limitations of Use No incremental benefit of NIASPAN coadministered with simvastatin or lovastatin on cardiovascular morbidity and mortality over and above that demonstrated for niacin, simvastatin, or lovastatin monotherapy has been established.

CONTRAINDICATIONS NIASPAN is contraindicated in the following conditions: • Active liver disease or unexplained persistent elevations in hepatic transaminases [see *Warnings and Precautions*] • Patients with active peptic ulcer disease • Patients with arterial bleeding • Hypersensitivity to niacin or any component of this medication [see *Adverse Reactions*]

WARNINGS AND PRECAUTIONS NIASPAN preparations should not be substituted for equivalent doses of immediate-release (crystalline) niacin. For patients switching from immediate-release niacin to NIASPAN, therapy with NIASPAN should be initiated with low doses (i.e., 500 mg at bedtime) and the NIASPAN dose should then be titrated to the desired therapeutic response.

Caution should also be used when NIASPAN is used in patients with unstable angina or in the acute phase of an MI, particularly when such patients are also receiving vasoactive drugs such as nitrates, calcium channel blockers, or adrenergic blocking agents.

Niacin is rapidly metabolized by the liver, and excreted through the kidneys. NIASPAN is contraindicated in patients with significant or unexplained hepatic impairment [see *Contraindications and Warnings and Precautions*] and should be used with caution in patients with renal impairment. Patients with a past history of jaundice, hepatobiliary disease, or peptic ulcer should be observed closely during NIASPAN therapy.

Skeletal Muscle Cases of rhabdomyolysis have been associated with concomitant administration of lipid-altering doses (≥ 1 g/day) of niacin and statins. Physicians contemplating combined therapy with statins and NIASPAN should carefully weigh the potential benefits and risks and should carefully monitor patients for any signs and symptoms of muscle pain, tenderness, or weakness, particularly during the initial months of therapy and during any periods of upward dosage titration of either drug. Periodic serum creatine phosphokinase (CPK) and potassium determinations should be considered in such situations, but there is no assurance that such monitoring will prevent the occurrence of severe myopathy.

The risk for myopathy and rhabdomyolysis are increased when lovastatin or simvastatin are coadministered with NIASPAN, particularly in elderly patients and patients with diabetes, renal failure, or uncontrolled hypothyroidism.

Liver Dysfunction Cases of severe hepatic toxicity, including fulminant hepatic necrosis, have occurred in patients who have substituted sustained-release (modified-release, timed-release) niacin products for immediate-release (crystalline) niacin at equivalent doses.

NIASPAN should be used with caution in patients who consume substantial quantities of alcohol and/or have a past history of liver disease. Active liver diseases or unexplained transaminase elevations are contraindications to the use of NIASPAN.

Niacin preparations have been associated with abnormal liver tests. In three placebo-controlled clinical trials involving titration to final daily NIASPAN doses ranging from 500 to 3000 mg, 245 patients received NIASPAN for a mean duration of 17 weeks. No patient with normal serum transaminase levels (AST, ALT) at baseline experienced elevations to more than 3 times the upper limit of normal (ULN) during treatment with NIASPAN. In these studies, fewer than 1% (2/245) of NIASPAN patients discontinued due to transaminase elevations greater than 2 times the ULN.

In three safety and efficacy studies with a combination tablet of NIASPAN and lovastatin involving titration to final daily doses (expressed as mg of niacin/mg of lovastatin) 500 mg/10 mg to 2500 mg/40 mg, ten of 1028 patients (1.0%) experienced reversible elevations in AST/ALT to more than 3 times the ULN. Three of ten elevations occurred at doses outside the recommended dosing limit of 2000 mg/40 mg; no patient receiving 1000 mg/20 mg had 3-fold elevations in AST/ALT.

Niacin extended-release and simvastatin can cause abnormal liver tests. In a simvastatin-controlled, 24 week study with a fixed dose combination of NIASPAN and simvastatin in 641 patients, there were no persistent increases (more than 3x the ULN) in serum transaminases. In three placebo-controlled clinical studies of extended-release niacin there were no patients with normal serum transaminase levels at baseline who experienced elevations to more than 3x the ULN. Persistent increases (more than 3x the ULN) in serum transaminases have occurred in approximately 1% of patients who received simvastatin in clinical studies. When drug treatment was interrupted or discontinued in these patients, the transaminase levels usually fell slowly to pretreatment levels. The increases were not associated with jaundice or other clinical signs or symptoms. There was no evidence of hypersensitivity.

In the placebo-controlled clinical trials and the long-term extension study, elevations in transaminases did not appear to be related to treatment duration; elevations in AST levels did appear to be dose

related. Transaminase elevations were reversible upon discontinuation of NIASPAN.

Liver function tests should be performed on all patients during therapy with NIASPAN. Serum transaminase levels, including AST and ALT (SGOT and SGPT), should be monitored before treatment begins, every 6 to 12 weeks for the first year, and periodically thereafter (e.g., at approximately 6-month intervals). Special attention should be paid to patients who develop elevated serum transaminase levels, and in these patients, measurements should be repeated promptly and then performed more frequently. If the transaminase levels show evidence of progression, particularly if they rise to 3 times ULN and are persistent, or if they are associated with symptoms of nausea, fever, and/or malaise, the drug should be discontinued.

Laboratory Abnormalities **Increase in Blood Glucose:** Niacin treatment can increase fasting blood glucose. Frequent monitoring of blood glucose should be performed to ascertain that the drug is producing no adverse effects. Diabetic patients may experience a dose-related increase in glucose intolerance. Diabetic or potentially diabetic patients should be observed closely during treatment with NIASPAN, particularly during the first few months of use or dose adjustment; adjustment of diet and/or hypoglycemic therapy may be necessary.

Reduction in platelet count: NIASPAN has been associated with small but statistically significant dose-related reductions in platelet count (mean of -11% with 2000 mg). Caution should be observed when NIASPAN is administered concomitantly with anticoagulants; platelet counts should be monitored closely in such patients.

Increase in Prothrombin Time (PT): NIASPAN has been associated with small but statistically significant increases in prothrombin time (mean of approximately +4%); accordingly, patients undergoing surgery should be carefully evaluated. Caution should be observed when NIASPAN is administered concomitantly with anticoagulants; prothrombin time should be monitored closely in such patients.

Increase in Uric Acid: Elevated uric acid levels have occurred with niacin therapy, therefore use with caution in patients predisposed to gout.

Decrease in Phosphorus: In placebo-controlled trials, NIASPAN has been associated with small but statistically significant, dose-related reductions in phosphorus levels (mean of -13% with 2000 mg). Although these reductions were transient, phosphorus levels should be monitored periodically in patients at risk for hypophosphatemia.

ADVERSE REACTIONS Because clinical studies are conducted under widely varying conditions, adverse reaction rates observed in the clinical studies of a drug cannot be directly compared to rates in the clinical studies of another drug and may not reflect the rates observed in practice.

Clinical Studies Experience In the placebo-controlled clinical trials database of 402 patients (age range 21-75 years, 33% women, 89% Caucasians, 7% Blacks, 3% Hispanics, 1% Asians) with a median treatment duration of 16 weeks, 16% of patients on NIASPAN and 4% of patients on placebo discontinued due to adverse reactions. The most common adverse reactions in the group of patients treated with NIASPAN that led to treatment discontinuation and occurred at a rate greater than placebo were flushing (6% vs. 0%), rash (2% vs. 0%), diarrhea (2% vs. 0%), nausea (1% vs. 0%), and vomiting (1% vs. 0%). The most commonly reported adverse reactions (incidence >5% and greater than placebo) in the NIASPAN controlled clinical trial database of 402 patients were flushing, diarrhea, nausea, vomiting, increased cough and pruritus.

In the placebo-controlled clinical trials, flushing episodes (i.e., warmth, redness, itching and/or tingling) were the most common treatment-emergent adverse reactions (reported by as many as 88% of patients) for NIASPAN. Spontaneous reports suggest that flushing may also be accompanied by symptoms of dizziness, tachycardia, palpitations, shortness of breath, sweating, burning sensation/skin burning sensation, chills, and/or edema, which in rare cases may lead to syncope. In pivotal studies, 6% (14/245) of NIASPAN patients discontinued due to flushing. In comparisons of immediate-release (IR) niacin and NIASPAN, although the proportion of patients who flushed was similar, fewer flushing episodes were reported by patients who received NIASPAN. Following 4 weeks of maintenance therapy at daily doses of 1500 mg, the incidence of flushing over the 4-week period averaged 8.6 events per patient for IR niacin versus 1.9 following NIASPAN.

Other adverse reactions occurring in $\geq 5\%$ of patients treated with NIASPAN and at an incidence greater than placebo are shown in Table 1 below.

Table 1. Treatment-Emergent Adverse Reactions by Dose Level in $\geq 5\%$ of Patients and at an Incidence Greater than Placebo; Regardless of Causality Assessment in Placebo-Controlled Clinical Trials

	Placebo-Controlled Studies NIASPAN Treatment ^o				
	Placebo (n = 157)	500 mg [†] (n = 87)	1000 mg (n = 110)	1500 mg (n = 136)	2000 mg (n = 95)
Gastrointestinal Disorders					
Diarrhea	13	7	10	10	14
Nausea	7	5	6	4	11
Vomiting	4	0	2	4	9
Respiratory					
Cough, increased	6	3	2	< 2	8
Skin and Subcutaneous Tissue Disorders					
Pruritus	2	8	0	3	0
Rash	0	5	5	5	0
Vascular Disorders					
Flushing [‡]	19	68	69	63	55

Note: Percentages are calculated from the total number of patients in each column.

[†] Adverse reactions are reported at the initial dose where they occur.

(continued)

Table 1. continued

^o Pooled results from placebo-controlled studies: for NIASPAN, n = 245 and median treatment duration = 16 weeks. Number of NIASPAN patients (n) are not additive across doses.

[†] The 500 mg/day dose is outside the recommended daily maintenance dosing range.

[‡] 10 patients discontinued before receiving 500 mg, therefore they were not included.

In general, the incidence of adverse events was higher in women compared to men.

Postmarketing Experience Because the below reactions are reported voluntarily from a population of uncertain size, it is generally not possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

The following additional adverse reactions have been identified during post-approval use of NIASPAN:

Hypersensitivity reactions, including anaphylaxis, angioedema, urticaria, flushing, dyspnea, tongue edema, larynx edema, face edema, peripheral edema, laryngismus, and vesiculobullous rash; maculopapular rash; dry skin; tachycardia; palpitations; atrial fibrillation; other cardiac arrhythmias; syncope; hypotension; postural hypotension; blurred vision; macular edema; peptic ulcers; eructation; flatulence; hepatitis; jaundice; decreased glucose tolerance; gout; myalgia; myopathy; dizziness; insomnia; asthenia; nervousness; paresthesia; dyspnea; sweating; burning sensation/skin burning sensation; skin discoloration, and migraine.

Clinical Laboratory Abnormalities

Chemistry: Elevations in serum transaminases [see *Warnings and Precautions*], LDH, fasting glucose, uric acid, total bilirubin, amylase and creatine kinase, and reduction in phosphorus.

Hematology: Slight reductions in platelet counts and prolongation in prothrombin time [see *Warnings and Precautions*].

DRUG INTERACTIONS **Statins** Caution should be used when prescribing niacin (≥ 1 gm/day) with statins as these drugs can increase risk of myopathy/rhabdomyolysis. Combination therapy with NIASPAN and lovastatin or NIASPAN and simvastatin should not exceed doses of 2000 mg NIASPAN and 40 mg lovastatin or simvastatin daily. [see *Warnings and Precautions*].

Bile Acid Sequestrants An *in vitro* study results suggest that the bile acid-binding resins have high niacin binding capacity. Therefore, 4 to 6 hours, or as great an interval as possible, should elapse between the ingestion of bile acid-binding resins and the administration of NIASPAN.

Aspirin Concomitant aspirin may decrease the metabolic clearance of nicotinic acid. The clinical relevance of this finding is unclear.

Antihypertensive Therapy Niacin may potentiate the effects of ganglionic blocking agents and vasoactive drugs resulting in postural hypotension.

Other Vitamins or other nutritional supplements containing large doses of niacin or related compounds such as nicotinamide may potentiate the adverse effects of NIASPAN.

Laboratory Test Interactions Niacin may produce false elevations in some fluorometric determinations of plasma or urinary catecholamines. Niacin may also give false-positive reactions with cupric sulfate solution (Benedict's reagent) in urine glucose tests.

USE IN SPECIFIC POPULATIONS **Pregnancy** Pregnancy Category C. Animal reproduction studies have not been conducted with niacin or with NIASPAN. It is also not known whether niacin at doses typically used for lipid disorders can cause fetal harm when administered to pregnant women or whether it can affect reproductive capacity. If a woman receiving niacin for primary hyperlipidemia becomes pregnant, the drug should be discontinued. If a woman being treated with niacin for hypertriglyceridemia conceives, the benefits and risks of continued therapy should be assessed on an individual basis.

All statins are contraindicated in pregnant and nursing women. When NIASPAN is administered with a statin in a woman of childbearing potential, refer to the pregnancy category and product labeling for the statin.

Nursing Mothers Niacin is excreted into human milk but the actual infant dose or infant dose as a percent of the maternal dose is not known. Because of the potential for serious adverse reactions in nursing infants from lipid-altering doses of nicotinic acid, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother. No studies have been conducted with NIASPAN in nursing mothers.

Pediatric Use Safety and effectiveness of niacin therapy in pediatric patients (≤ 16 years) have not been established.

Geriatric Use Of 979 patients in clinical studies of NIASPAN, 21% of the patients were age 65 and over. No overall differences in safety and effectiveness were observed between these patients and younger patients, and other reported clinical experience has not identified differences in responses between the elderly and younger patients, but greater sensitivity of some older individuals cannot be ruled out.

Renal Impairment No studies have been performed in this population. NIASPAN should be used with caution in patients with renal impairment [see *Warnings and Precautions*].

Hepatic Impairment No studies have been performed in this population. NIASPAN should be used with caution in patients with a past history of liver disease and/or who consume substantial quantities of alcohol. Active liver disease, unexplained transaminase elevations and significant or unexplained hepatic dysfunction are contraindications to the use of NIASPAN [see *Contraindications and Warnings and Precautions*].

Gender Data from the clinical trials suggest that women have a greater hypolipidemic response than men at equivalent doses of NIASPAN.

OVERDOSAGE Supportive measures should be undertaken in the event of an overdose.

PATIENT COUNSELING INFORMATION **Patient Counseling** Patients should be advised to adhere to their National Cholesterol Education Program (NCEP) recommended diet, a regular exercise program, and periodic testing of a fasting lipid panel. Patients should be advised to inform other healthcare professionals prescribing a new medication that they are taking NIASPAN. The patient should be informed of the following:

Dosing Time NIASPAN tablets should be taken at bedtime, after



"As the master craftsman who opened the famous Lincoln Pocket Watch in Washington, D.C., I recently reviewed the Stauer Meisterzeit timepiece. The assembly and the precision of the mechanical movement are the best in its class."

—George Thomas
Towson Watch Company



We Can Only Find One

A rare chance to claim a unique piece of watchmaking history for under \$100!

Eighty-six years ago, a watchmaker in Paris famous for building the magnificent clocks at Versailles created a legendary timepiece. He invented the first watch with an automatic mechanical drive. These innovative movements required no batteries and never needed to be manually wound. Only seven of these ultra-rare watches were ever made and we've studied the one surviving masterpiece in a watch history museum. Inspired by history, classic design and technology, our Stauer *Meisterzeit* has been painstakingly handcrafted to meet the demanding standards of vintage watch collectors.

Why the new "antique" is better than the original. The original timepiece was truly innovative, but, as we studied it closely, we realized that we could engineer ours with a much higher level of precision. The 27-ruby-jewel movement utilizes an automatic self-winding mechanism inspired by a patent from 1923, but built on \$31 million in state-of-the-art Swiss-made machinery. With an exhibition back, you can see into the heart of the engineering and view the rotor spin—it's powered by the movement of your body.

This limited edition Stauer *Meisterzeit* allows you to wear a watch far more exclusive than most new "upscale" models. Here is your chance to claim a piece of watchmaking history in a rare design that is priced to wear everyday.

Elegant and accurate. This refined beauty has a fastidious side. Each movement and engine-turned rotor is tested for 15 days and then certified before it leaves the factory.

The best part is that with our special price, you can wear a superb classic historical reproduction watch and laugh all the way to the bank. Stauer specializes in classic timeless watches and jewelry that are made for the millionaires who want to keep their millions. This watch will quickly move to heirloom status in your household.



View the precision movement of the *Meisterzeit* through the rear exhibition port.

Try it for 30 days and if you are not thrilled with the beauty and construction of the *Meisterzeit*, simply return it for a refund of the purchase price.

Extremely limited availability. Since it takes about 6 months to build each watch, the release is a limited edition, so please be sure to order yours soon.

WATCH SPECS:

- 14K Gold-clad case and bezel
- Precision 27-jeweled movement
- Interior dials display day and month
- Croc-embossed leather strap
- Fits 6 3/4"-8 1/4" wrist

76% OFF

Exclusively Through Stauer

Stauer Meisterzeit Watch—~~\$495~~
Now only \$99 +S&P **Save \$396!**

Call now to take advantage of this limited offer.

1-888-324-4351

Promotional Code **MZW387-03**
Please mention this code when you call.

Stauer® 14101 Southcross Drive W.,
Dept. MZW387-03
Burnsville, Minnesota 55337
www.stauer.com

Smart Luxuries—Surprising Prices

A SHOOTING EXPERIENCE LIKE NO OTHER.



55
million
NIKKOR



At the heart of the image™

The amazing 16.2 megapixel Nikon D7000, with 1080p HD Movie. Nikon has once again redefined the passionate shooter's D-SLR: the D7000. With stunning image quality, thanks to a 16.2 megapixel CMOS DX format sensor; an astonishing low-noise ISO range of 100–6400, and ISO performance up to 25,600 that will enable shooting in extremely low light; continuous shooting of up to 6 frames per second; breathtaking 1080p HD Movie, with full-time autofocus and full manual control; and an extraordinary 39-point autofocus system. Add legendary NIKKOR optics and you've got a D-SLR that will push your abilities further than any enthusiast's camera Nikon has ever created. Period. **For more, go to www.nikonusa.com/D7000**

Nikon® and D7000™ are registered trademarks of Nikon Corporation. ©2011 Nikon Inc.

LETTERS

Conquering an Infinite Cave

I am pleased to see that the Rao Thuong River cave area of Vietnam has apparently recovered from the ravages of a long war. However, I must comment on the caption on page 113. While the statement "during the Vietnam War, North Vietnamese soldiers hid in caves from the U.S. air strikes" may be technically correct, it conveys the sense that they were passive victims. In fact they defended the Mu Gia Pass and the Ban Karai Pass to the north and south of the area with fierce antiaircraft fire. Their ground forces and gun emplacements extended well into Laos. Both passes were part of the Ho Chi Minh Trail and were major truck supply routes into Laos and south into (then) South Vietnam and Cambodia. In my opinion, the north is equally responsible for many of the depredations that befell the people and land of Southeast Asia.

ED DiBELLO
Albuquerque, New Mexico

Having done some spelunking, I read this article with interest. The article was fine, but the title was poorly chosen, reflecting both human hubris and hyperbole. Nothing in nature is ours to conquer, nor is nature either infinite or inexhaustible. I wonder how long it would take all seven billion of us to fill up Hang Son Doong with our trash.

VALERIE KOZLOVSKY
Maple, Wisconsin

"Conquering an Infinite Cave" was utterly absorbing. Having been taken to Carlsbad Caverns and Mammoth Cave as a child, I have had a lifelong interest in all things underground. I've visited caves and small mines in the Peak District in England, the Big Pit coal mine in Wales, Kartchner Caverns and a copper mine in Arizona. This article on the cave systems of Vietnam was so well connected to the graphic on pages 116-17 that I felt like I was there. Keep the cave articles coming!

MARION MOXLEY
Palos Verdes Estates, California



At the heart of the image™

**SERIOUS SHOOTERS
HAVE NEVER
BEEN KNOWN TO
TRAVEL LIGHT.
UNTIL NOW.**



THE INCREDIBLE NIKON COOLPIX P7000.

Nothing matters more to serious shooters than image quality. So when it comes to a smaller camera, only one measures up: the Nikon COOLPIX P7000, with a large 1/1.7" CCD sensor, RAW shooting capability, the option of full manual control, NIKKOR ED glass, HD Movie, Nikon Speedlight compatibility and much more. It's the first good reason, ever, to shoot with something other than your D-SLR.

For more, go to www.nikonusa.com/P7000

Nikon® and P7000™ are registered trademarks of Nikon Corporation. ©2011 Nikon Inc.



Brynn Bayman Crowthorne, England

British students roll down the dunes in “cartwheel pairs” near the Gobabeb research station in Namibia’s Namib Desert. “I’d just made them sit still for 45 minutes to take in the beauty of the landscape,” says geography teacher Bayman, 44. “Their reply was to show off their youth. By the time they reached the bottom, they had sand in every part of their clothing and hair.”



Mátyás Sarvady
Budapest, Hungary

“When I visit my grandparents,” says Sarvady, 26, “I see how time has changed them. But with a camera in my hands, I feel like I have the power to stop time.” After waiting two weeks for the weather to cooperate at his elders’ home in Săcueni, Romania, he did just that. Photographing them at a summery table in a wheat field resulted in this shot.

Find out how to submit your own photograph at ngm.com/yourshot.

**GET THAT
SUMMERTIME
FEELING**



Pringles speakers arriving Summer 2011.
Learn more at pringles.com

Everything pops with Pringles!



VISIONS OF EARTH

Mozambique The glowing hues of dusk bathe a mud-splattered gold miner in the border province of Manica. The area draws scores of workers from neighboring Zimbabwe who pan for traces of the precious metal in turbid waters.

PHOTO: ROBIN HAMMOND. PANDS



China Gleaming with mouthwatering perfection, a “banquet” of stones resembling food adorns a table at the sixth International Rare Stone Festival in Liuzhou. About 3,000 specimens were on show.





Finland Mimmi the brown bear shows her flair for flexibility during an afternoon stretch at the Ähtäri Zoo. Despite intense summer heat, the lively resident lifted paws for minutes at a time in poses learned from her mother.



Order prints of National Geographic photos online at [PrintsNGS.com](https://www PrintsNGS.com).

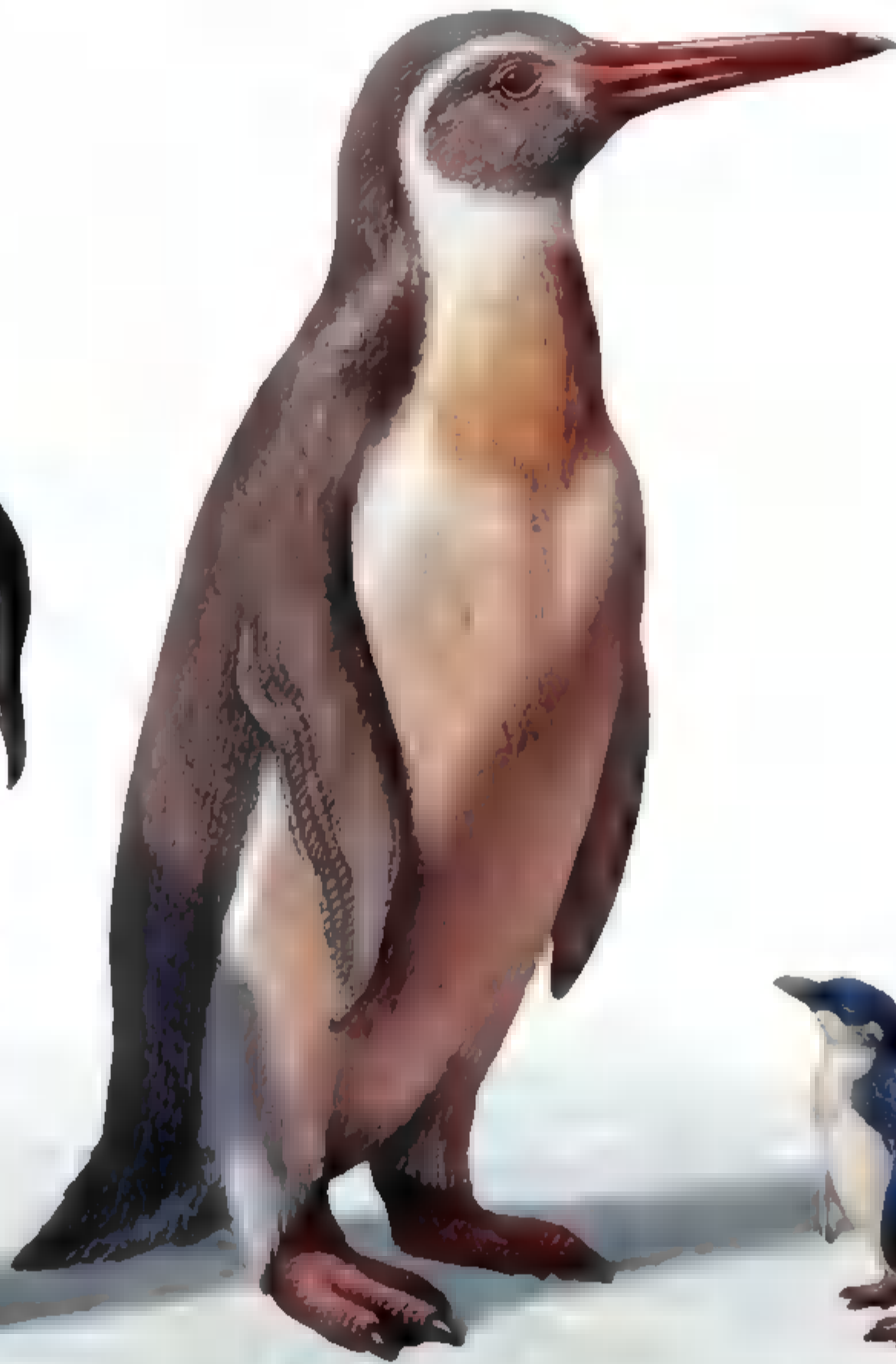
PHOTO META PENCA



FOSSILS



Aptenodytes forsteri
(Emperor penguin)



Inkayacu paracasensis



Eudyptula minor
(Little penguin)

NG GRANTEE Prehistoric Penguin Nothing is black-and-white, it seems. Not even penguins. That's what University of Texas paleontologist Julia Clarke found after unearthing 36-million-year-old remains (below) in Peru's Paracas National Reserve—the first penguin fossil ever found with evidence of feathers intact.

Like its present-day relatives, *Inkayacu paracasensis* was a deft swimmer. Unlike them, it weighed more than a hundred pounds and sported a coat with ruddy feathers. Clarke's team deduced the color last year after comparing tiny pigment packages called melanosomes from the fossilized plumage with those of living species.



This part of coastal Peru has recently produced other big penguin finds. Clarke says the area could be key to painting the full picture of the birds' evolution. For now, a touch of color has been applied.

—Catherine Zuckerman



A reddish brown penguin from the Eocene (above, center) would have dwarfed its modern kin—and stood shoulder-high to a man.



PERU
Lima
PARACAS
NATIONAL
RESERVE

SOUTH
AMERICA

Is **Diabetic Nerve Pain** keeping you out of the game?



LYRICA[®]
PREGABALIN [©]
capsules



Diabetes damages nerves which may cause a unique type of pain.*

*Artist depiction of diabetic nerve pain symptoms



Lyrice is believed to work on these damaged nerves.

Move towards relief with **Lyrice**.

Burning, throbbing symptoms in your hands or feet? Lyrice is FDA approved to effectively treat Diabetic Nerve Pain. Over-the-counter pain relief pills are not FDA approved to treat this unique kind of pain. **Lyrice studies showed that patients had less Diabetic Nerve Pain and felt better.**

Start the Lyrice conversation with your doctor today.

Prescription Lyrice is not for everyone. Tell your doctor right away about any serious allergic reaction that causes swelling of the face, mouth, lips, gums, tongue, throat or neck or any trouble breathing or that affects your skin. Lyrice may cause suicidal thoughts or actions in a very small number of people. Call your doctor right away if you have new or worsening depression, suicidal thoughts or actions, or unusual changes in mood or behavior. Lyrice may cause swelling of your hands, legs and feet. Some of the most common side effects of Lyrice are dizziness and sleepiness. Do not drive or work with machines until you know how Lyrice affects you. Other common side effects are blurry vision, weight gain, trouble concentrating, dry mouth, and feeling "high." Also, tell your doctor right away about muscle pain along with feeling sick and feverish, or any changes in your eyesight including blurry vision or any skin sores if you have diabetes. You may have a higher chance of swelling, hives or gaining weight if you are also taking certain diabetes or high blood pressure medicines. Do not drink alcohol while taking Lyrice. You may have more dizziness and sleepiness if you take Lyrice with alcohol, narcotic pain medicines, or medicines for anxiety. If you have had a drug or alcohol problem, you may be more likely to misuse Lyrice. Tell your doctor if you are planning to father a child. Talk with your doctor before you stop taking Lyrice or any other prescription medication.

Please see Important Facts Brief Summary on adjacent page.

To learn more visit www.lyrica.com or call toll-free 1-888-9-LYRICA (1-888-959-7422).

You are encouraged to report negative side effects of prescription drugs to the FDA.

Visit www.FDA.gov/medwatch or call 1-800-FDA-1088.

© 2010 Pfizer Inc. All rights reserved. PBP00916C

IMPORTANT FACTS



(LEER-i-kah)

IMPORTANT SAFETY INFORMATION ABOUT LYRICA

LYRICA may cause serious, even life threatening, allergic reactions. Stop taking LYRICA and call your doctor right away if you have any signs of a serious allergic reaction:

- Swelling of your face, mouth, lips, gums, tongue, throat or neck
- Have any trouble breathing
- Rash, hives (raised bumps) or blisters

Like other antiepileptic drugs, LYRICA may cause suicidal thoughts or actions in a very small number of people, about 1 in 500.

Call your doctor right away if you have any symptoms, especially if they are new, worse or worry you, including:

- New or worsening depression
- Suicidal thoughts or actions
- Unusual changes in mood or behavior

Do not stop LYRICA without first talking with your doctor.

LYRICA may cause swelling of your hands, legs and feet.

This swelling can be a serious problem with people with heart problems.

LYRICA may cause dizziness or sleepiness.

Do not drive a car, work with machines, or do other dangerous things until you know how LYRICA affects you. Ask your doctor when it is okay to do these things.

ABOUT LYRICA

LYRICA is a prescription medicine used in adults 18 years and older to treat:

- Pain from damaged nerves that happens with diabetes or that follows healing of shingles
- Partial seizures when taken together with other seizure medicines
- Fibromyalgia (pain all over your body)

Who should NOT take LYRICA:

- Anyone who is allergic to anything in LYRICA

BEFORE STARTING LYRICA

Tell your doctor about all your medical conditions, including if you:

- Have had depression, mood problems or suicidal thoughts or behavior
- Have or had kidney problems or dialysis
- Have heart problems, including heart failure
- Have a bleeding problem or a low blood platelet count
- Have abused prescription medicines, street drugs or alcohol in the past
- Have ever had swelling of your face, mouth, tongue, lips, gums, neck, or throat (angioedema)
- Plan to father a child. It is not known if problems seen in animal studies can happen in humans.
- Are pregnant, plan to become pregnant or are breastfeeding. It is not known if LYRICA will harm your unborn baby. You and your doctor should decide whether you should take LYRICA or breast-feed, but not both.

Tell your doctor about all your medicines. Include over-the-counter medicines, vitamins, and herbal supplements.

LYRICA and other medicines may affect each other causing side effects. Especially tell your doctor if you take:

- Angiotensin converting enzyme (ACE) inhibitors. You may have a higher chance for swelling and hives.

BEFORE STARTING LYRICA, continued

- Avandia* (rosiglitazone)*, Avandamet* (rosiglitazone and metformin)* or Actos* (pioglitazone)** for diabetes. You may have a higher chance of weight gain or swelling of your hands or feet.
- Narcotic pain medicines (such as oxycodone), tranquilizers or medicines for anxiety (such as lorazepam). You may have a higher chance for dizziness and sleepiness.
- Any medicines that make you sleepy

POSSIBLE SIDE EFFECTS OF LYRICA

LYRICA may cause serious side effects, including:

- See "Important Safety Information About LYRICA."
- Muscle problems, pain, soreness or weakness along with feeling sick and fever
- Eyesight problems including blurry vision
- Weight gain. Weight gain may affect control of diabetes and can be serious for people with heart problems.
- Feeling "high"

If you have any of these symptoms, tell your doctor right away.

The most common side effects of LYRICA are:

- Dizziness
- Blurry vision
- Weight gain
- Sleepiness
- Trouble concentrating
- Swelling of hands and feet
- Dry mouth

If you have diabetes, you should pay extra attention to your skin while taking LYRICA and tell your doctor of any sores or skin problems.

HOW TO TAKE LYRICA

Do:

- Take LYRICA exactly as your doctor tells you. Your doctor will tell you how much to take and when to take it. Take LYRICA at the same times each day.
- Take LYRICA with or without food.

Don't:

- Drive a car or use machines if you feel dizzy or sleepy while taking LYRICA.
- Drink alcohol or use other medicines that make you sleepy while taking LYRICA.
- Change the dose or stop LYRICA suddenly. You may have headaches, nausea, diarrhea, or trouble sleeping if you stop taking LYRICA suddenly.
- Start any new medicines without first talking to your doctor.

NEED MORE INFORMATION?

- Ask your doctor or pharmacist. This is only a brief summary of important information.
- Go to www.lyrica.com or call 1-866-459-7422 (1-866-4LYRICA).

Uninsured? Need help paying for Pfizer medicines? Pfizer has programs that can help. Call 1-866-706-2400 or visit www.PfizerHelpfulAnswers.com.



PARKE-DAVIS, Division of Pfizer Inc., New York, NY 10017
©2010 Pfizer Inc. All rights reserved. Printed in the USA.
Version January 2010

* Avandia and Avandamet are registered trademarks of GlaxoSmithKline.
** Actos is a registered trademark of Takeda Chemicals Industries, Ltd., and is used under license by Takeda Pharmaceuticals of America, Inc., and Eli Lilly and Co.

Rx only

"This is a stunning ring... I just love your jewelry. Everything you do, you do with such class... thanks again!"

— J. H. from Central Ohio



Renew Your Wows

Scientists finally reveal the secret to a happy marriage!

Your marriage is not a wedding. It's not a honeymoon or an anniversary. Your marriage is every ordinary moment in between. It's a soft kiss on the neck at the kitchen sink. Quiet mornings together with the Sunday paper. The smoldering look that still gives you goose bumps. But since it's still up to you to make the everyday extraordinary, we'd like you to meet our stunning DiamondAura® *Dearly Beloved Ring Set*.

It doesn't matter if you're newly-married or celebrating 50 years of wedded bliss, this classic set is the ultimate romantic reminder that your love was built to last.

What's the secret to a happy marriage? Remember these two words: just because. That's it. You don't need a reason for romance. "Just because" is more than enough. Anybody can come through on the big days, but real romantics know the value of a surprise attack. When it comes to these *Dearly Beloved Rings*, it's much more dramatic if the lovely couple shows up unannounced.

Give her proof that marrying you was the best idea she ever had. The DiamondAura® *Dearly Beloved Ring Set* capture the thrill of old-fashioned romance with over 2½ carats of dazzling, lab-created DiamondAura set in fine sterling silver. The ring boasts a brilliant, 2-carat round-cut that sparkles with even more fire and clarity than a "D" flawless natural diamond. And its shoulders shimmer with brilliant, channel-set rounds. The happy couple is

made complete with a stunning companion band of fine .925 sterling silver, lavished in elegant heirloom detail and channel-set with more than a dozen white DiamondAura dazzers.

Your satisfaction is 100% guaranteed. If for any reason you're not completely smitten with your DiamondAura *Dearly Beloved Set*, return the rings within 30 days for a full refund of your purchase price.

But we're certain that whether you're popping the question for the first time or marking another marital milestone, this pair is sure to become a highlight of your "happily ever after."

JEWELRY SPECS:

- 2 ¾ ctw DiamondAura® ring
- .925 sterling silver setting

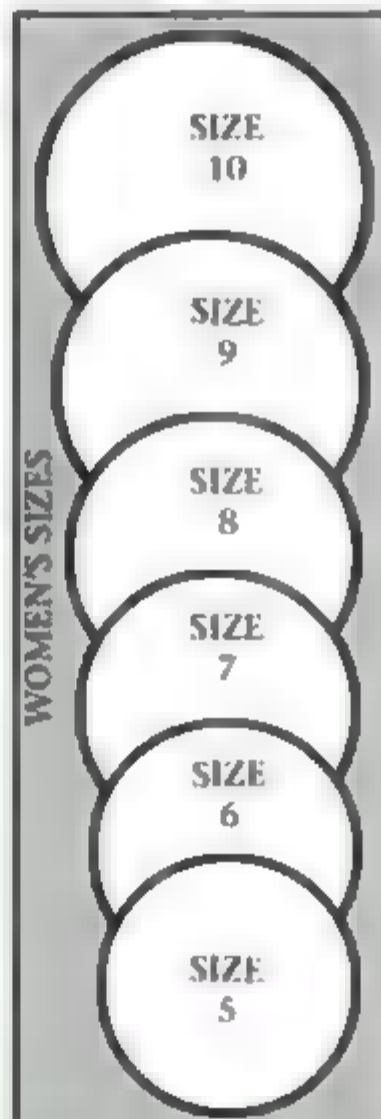
DiamondAura® Dearly Beloved Set (2 ¾ ctw) — ~~\$295~~ **\$145** + S&P

Specify ring whole size 5-10 when ordering.

Call now to take advantage of this extremely limited offer.

1-800-859-6575

Promotional Code DBS122-01
Please mention this code when you call.



USING THE RING SIZE CHART
Place one of her rings on top of one of the circle diagrams. Her ring size is the circle that matches the inside diameter of the ring diagram. If her ring falls between sizes, order the next larger size.

ACCREDITED BUSINESS Stauer has a Better Business Bureau Rating of A+

Stauer® 14101 Southcross Drive W., Dept. DBS122-01 Burnsville, Minnesota 55337 www.stauer.com



Mark of Youth A sassy little mole like Marilyn Monroe's has long been associated with beauty. Now research at King's College London suggests another connection. People with more than a hundred moles may age more slowly than others, perhaps resulting in fewer wrinkles and a reduced risk of osteoporosis.

The reason involves segments of DNA called telomeres, which may shrink over time. Having many moles indicates longer telomeres. This helps put off the moment when some cells are no longer able to divide and renew tissues. It may also make "moley" people—as much as 10 percent of Caucasians—prone to cancers, but the benefits can sometimes outweigh the risk, says lead scientist Veronique Bataille, a dermatologist. "I tell patients to be vigilant, but consider the positive side of having moles." —A. R. Williams

MOLE OR FRECKLE?

A mole is a cluster of pigment-producing cells that appears as a well-defined dot and is sometimes raised. A freckle is a splotch of pigment, often a sign of sun damage.

**FREE CAR CHARGER
AND LEATHER CASE!**
A \$43⁹⁹ value. Offer ends 5/31/11.



Does your cell phone come with an emergency response team?

Peace of mind on the go.

As the inventor of the easy-to-use Jitterbug, GreatCall is committed to products and services that help you stay connected, safe and healthy. And now the Jitterbug can give you the freedom of knowing someone is there for you if needed, 24 hours a day, seven days a week. Introducing 5Star Personal Security.

We're looking out for you.

5Star is a brand new app that transforms the Jitterbug into a personal security device. By simply pressing 5 and *, our agents can find your location and provide you with an immediate response, no matter how big or small the emergency. 5Star also comes with our award-winning LiveNurse app FREE, so you can speak to a live registered nurse any time of the day and get unlimited health advice.

A great phone is nothing without great service.

As a pioneer in cell phone simplicity, GreatCall is all about making life a little bit easier. Our original Jitterbug, in particular, offers effortless navigation and clear powerful sound. When you call our customer service center, you'll get a real live person who's there for you 24 hours a day. Weekends too. You see, at GreatCall, we understand the human touch can make all the difference.

Great coverage. Great people. Great value.

GreatCall is also proud to offer 100% U.S. Based Customer Service and nationwide coverage on one of the largest and most dependable wireless networks. All with no contracts, and rate plans starting at just \$14⁹⁹ a month. Contact GreatCall today to learn more.



Purchase a Jitterbug

- ✓ Effortless navigation
- ✓ 24/7 Live Operators
- ✓ Plans start at \$14⁹⁹/month

Add our new 5Star app

- ✓ Immediate response
- ✓ Latest GPS technology
- ✓ Trained NAED* certified agents

Get LiveNurse FREE**

- ✓ 24/7 live registered nurse
- ✓ Unlimited health advice
- ✓ No appointment necessary

To order or learn more, call
1-866-765-0202
or visit us at greatcall.com/offer

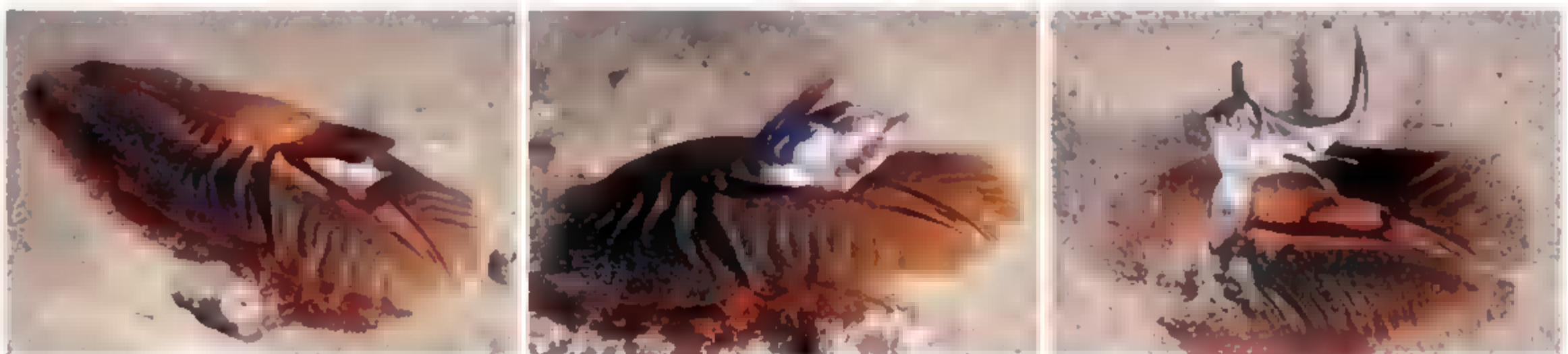
*National Academies of Emergency Dispatch. All rate plans, services and applications require the purchase of a GreatCall phone and a one-time set up fee of \$35. Coverage and service is not available everywhere. Other charges and restrictions may apply. Screen images simulated. There are no additional fees to call GreatCall's 24-hour U.S. Based Customer Service. However, for calls to an Operator in which a service is completed, minutes will be deducted from your monthly balance equal to the length of the call and any call connected by the Operator, plus an additional 5 minutes. 5Star service may not be available in remote or enclosed areas. We will be able to track an approximate location when a device is turned on, but cannot guarantee an exact location. ** LiveNurse is free with purchase of the 5Star Personal Security app. LiveNurse, brought to you in partnership with FONEMED®, is not a substitute for dialing 911 and should not be used in a case of emergency. FONEMED's registered nurses offer advice regarding health care decisions, but they do not prescribe medications or make diagnoses. GreatCall is not liable for any act or omission, including negligence, of any FONEMED employee. LiveNurse is free on select plans, but airtime charges do apply for the length of the calls made to the service. GreatCall is not a health care provider and does not provide health care services. You should seek the advice of your physician if you have any questions about medical treatment. Monthly rate plans do not include government taxes or assessment surcharges. Prices and fees are subject to change. Jitterbug and GreatCall are registered trademarks of GreatCall, Inc. Samsung is a registered trademark of Samsung Electronics America, Inc. and/or its related entities. Copyright ©2011 GreatCall, Inc.



NG GRANTEE **Mishmash Fish** With a genus name meaning “beautiful snout,” *Callorhinchus milii* ought to be easier on the eyes. But here’s the marine elephant fish, a close kin of sharks and rays that lurks deep in the southwestern Pacific Ocean. That big nozzle roots through sand in search of prey; like a shark’s rostrum, it detects weak electric fields. Winglike fins, fused teeth, and a mate-clasping organ atop males’ heads round out the beast.

The University of Cambridge’s Andrew Gillis uses the fish to study the early role of genes in shaping anatomy. Evolution is efficient, he says, modifying existing forms rather than always starting anew. So the same process makes a fish’s fin and a monkey’s hand. And “just a few tweaks in the timing of gene activity in the egg can turn a fish like *Jaws* into one with an elephant’s face.” —Jennifer S. Holland

An adult elephant fish (above) can grow to four feet long. It lives 600 feet beneath the sea but will migrate to shallows to lay eggs. Eight months later young hatch (below) from leathery half-foot shells.



gravity defyer™

VERSOSHOCK REVERSE TRAMPOLINE SOLE

Scientifically Engineered to Defy Gravity

Defy Pain, Defy Aging, Defy Fatigue

This is my story

I used to be more active. I used to run, play basketball, tennis, football... I was more than a weekend warrior. I woke up every day filled with life! But now, in my late 30's, I spend most of my day in the office or sacked out in front of the TV. I rarely get to the gym – not that I don't like working out, it's the nagging pain in my knees and ankles.

Customer Satisfaction Speaks for Itself!

out of 5 customers purchase a 2nd pair within 3 months.

I'm embarrassed to admit that I've grown a spare tire (I'm sure it's hurting my love life). Nowadays I rarely walk. For some reason it's just harder now. Gravity has done a job on me.



Wear them and you'll know

That's what my doctor recommended. He said, "Gravity Defyer shoes are pain-relieving shoes." He promised they would change my life—like they were a fountain of youth. "They ease the force of gravity, relieving stress on your heels, ankles, knees and back. They boost

your energy by propelling you forward." The longer he talked, the more sense made. He was even wearing a pair himself!

Excitement swept through my body like a drug

I received my package from GravityDefyer.com and rushed to tear it open like a kid at Christmas. Inside I found the most amazing shoes I had ever seen – different than most running shoes. Sturdy construction. Cool colors. Nice lines... I was holding a miracle of technology. This was the real thing.

GDefy Benefits

- Relieve pain
- Ease joint & spinal pressure
- Reduce fatigue & tiredness
- Be more active
- Have more energy
- Appear taller
- Jump higher, walk and run faster
- Have instant comfort
- Cool your feet & reduce foot odor
- Elevate your performance

I put them on and all I could say was, "WOW!" In minutes I was out the door.

I was invincible; tireless in my new Gravity Defyer shoes. It was as if my legs had been replaced with super-powered bionics. What the doctor promised was all correct. No more knee pain. I started to lose weight. At last, I was pain free and filled with energy! I was back in the game. Gravity had no power over me!



ABSORB SHOCK
Eliminate pain from every step.



REBOUND PROPELS YOU FORWARD
Reduce fatigue. Be more active

Nothing to lose: 30 Day Free Trial*

So, my friend, get back on your feet like I did. Try Gravity Defyer for yourself. You have nothing to lose but your pain.

Tell us your story!
Login at Gravitydefyer.com
and share your experience.



Semi-Rigid
Heel Stabilizer
Cage

Removable
Comfort-Fit
Insole
Accommodates
most orthotics

Versoshock™ Shock-Absorbing Membrane

Smart Memory™ Memory Foam

Ultra Ventilation™ Port
Cools & Reduces Moisture

Resilient High Grade
Ethylene-Vinyl Acetate
(EVA) Midsole
Rockers construction protects
metatarsal bones and aids fluid
stepping motions

Rugged Polymer Sole

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

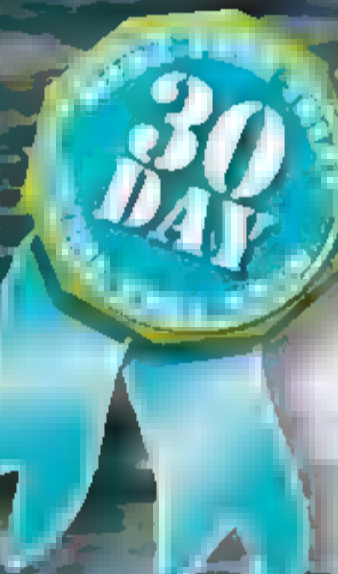
MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value



EXCLUSIVE ONLINE OFFER

TRY TODAY AND PAY IN 30 DAYS* Not available in stores.

Take advantage of this exclusive offer at

www.GravityDefyer.com/MH4ECC3

or by phone, dial (800) 429-0039 and mention the promotional code below.

Promotional Code: **MH4ECC3**

*Pay only \$14.95 shipping and handling – non-refundable.



MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

MSRP \$129.95 value

POPULATION

Food for Thought

There will soon be seven billion humans on Earth, but how does that number compare to other species on the planet? We are certainly outnumbered by ants. Harvard biologist and ant expert Edward O. Wilson has estimated that there are a thousand trillion to ten thousand trillion ants at any one time.* That would be about ■ million ants for every one of us. And doesn't it seem like that when they invade our kitchens?

Estimating animal populations, especially wild ones, is hard, but here's a look at one category of animals we can count: the ones we eat. —Nigel Holmes

SEVEN BILLION

Number of animals killed for food Worldwide, 2009

1.7 million camels

24 million water buffalo

293 million cows

398 million goats

518 million sheep

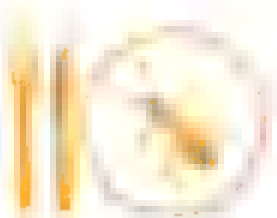
633 million turkeys

1.1 billion rabbits

1.3 billion pigs

2.6 billion ducks

52 billion chickens



*And they're edible. Ants are a good source of protein and are considered a delicacy in many parts of the world.



It's not the advice you'd expect. Learning a new language seems formidable, as we recall from years of combat with grammar and translations in school. Yet infants begin at birth. They communicate at eighteen months and speak the language fluently before they go to school. And they never battle translations or grammar explanations along the way. Born into a veritable language jamboree, children figure out language purely from the sounds, objects and interactions around them. Their senses fire up neural circuits that send the stimuli to different language areas in the brain. Meanings fuse to words. Words string into structures. And language erupts.

Three characteristics of the child's language-learning process are crucial for success:

First, and most importantly, a child's natural language-learning ability emerges only in a speech-soaked, immersion environment free of translations and explanations of grammar. Second, a child's language learning is dramatically accelerated by constant feedback from family and friends. Positive correction and persistent reinforcement nurture the child's language and language skills into full communicative expression. Third, children learn through play, whether it's the arm-waving balancing act that announces their first step or the spluttering preamble to their first words. All the conversational chatter skittering through young children's play with parents and playmates — "...what's this..." "...clap, clap your hands..." "...my ball..." — helps children develop language skills that connect them to the world.

Adults possess this same powerful language-learning ability that orchestrated our language success as children.

Sadly, our clashes with vocabulary drills and grammar explanations force us to conclude it's hopeless. We simply don't have "the language-learning gene." At Rosetta Stone, we know otherwise. You can recover your native language-learning ability as an

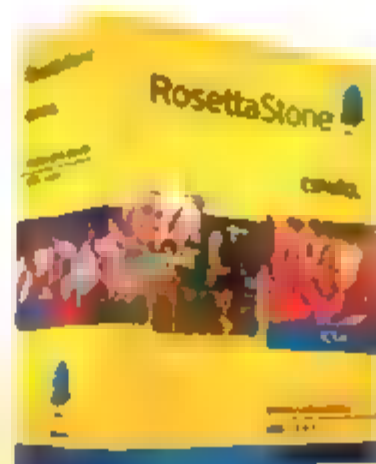
**What's the fastest way to learn a language?
ACT LIKE A BABY.**

adult by prompting your brain to learn language the way it's wired to learn language: by complete immersion. Our award-winning, computer-based method does just that. Dynamic Immersion® un-

locks the innate language-learning ability you acquired before birth and mastered as a child. By recreating the immersion context in which you learned your first language, you understand, speak, read and write your new language with confidence and accuracy from the beginning — without translations and explanations. At every step and in every skill, you receive instant, actionable feedback, including speech recognition and analysis technologies that prepare you for everyday conversations. And Adaptive Recall™ brings back material just when you need it to reinforce and perfect your learning.

Every act of learning is an act of play for children and there's no reason it should be different for learners of any age.

With Rosetta Stone® programs, you rediscover the joy of learning language. Clever, puzzle-like activities produce sudden "Aha!" moments and astonishing language discoveries. Your "language brain" remembers. We see it all the time. A slow smile sneaks across the learner's face after just a few screens. It's a smile of recognition, as though the brain suddenly recalls what it was like to learn language as a child, as though it realizes, "Aha! I've done this before." Act like a baby? You bet. Visit our website and find out how you can reactivate your own innate, language-learning ability with Rosetta Stone. It's the fastest way to learn a language. Guaranteed.*



WIN/MAC compatible

SAVE 10% when you order today.

Level 1	Reg. \$249	NOW \$224
Level 1, 2, & 3	Reg. \$579	NOW \$521
Level 1, 2, 3, 4, & 5	Reg. \$749	NOW \$674

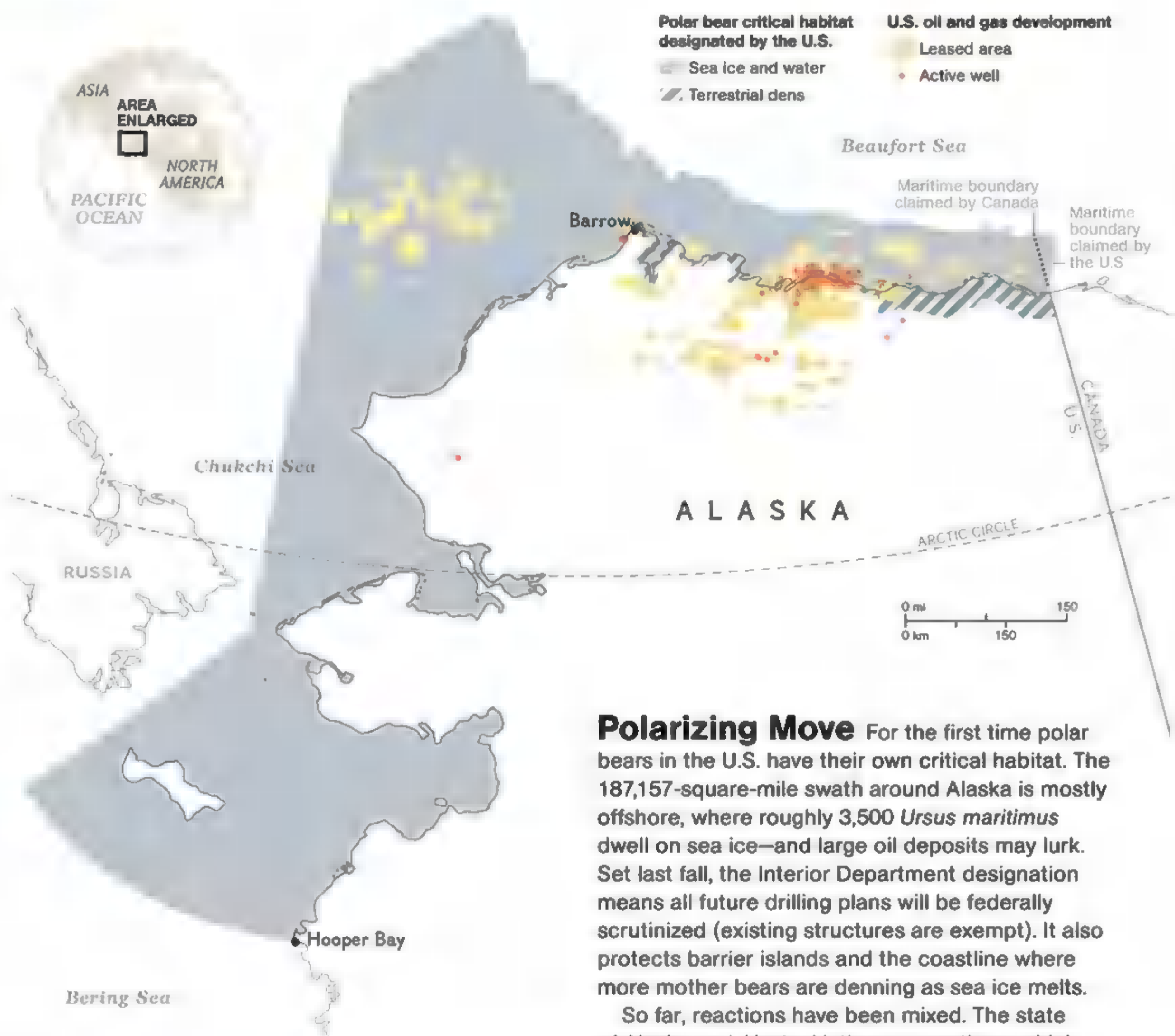
SIX-MONTH, NO-RISK, MONEY-BACK GUARANTEE*

PICK UP A NEW LANGUAGE TODAY.
(877) 260-4356 RosettaStone.com/ngs051
Use promo code ngs051 when ordering.



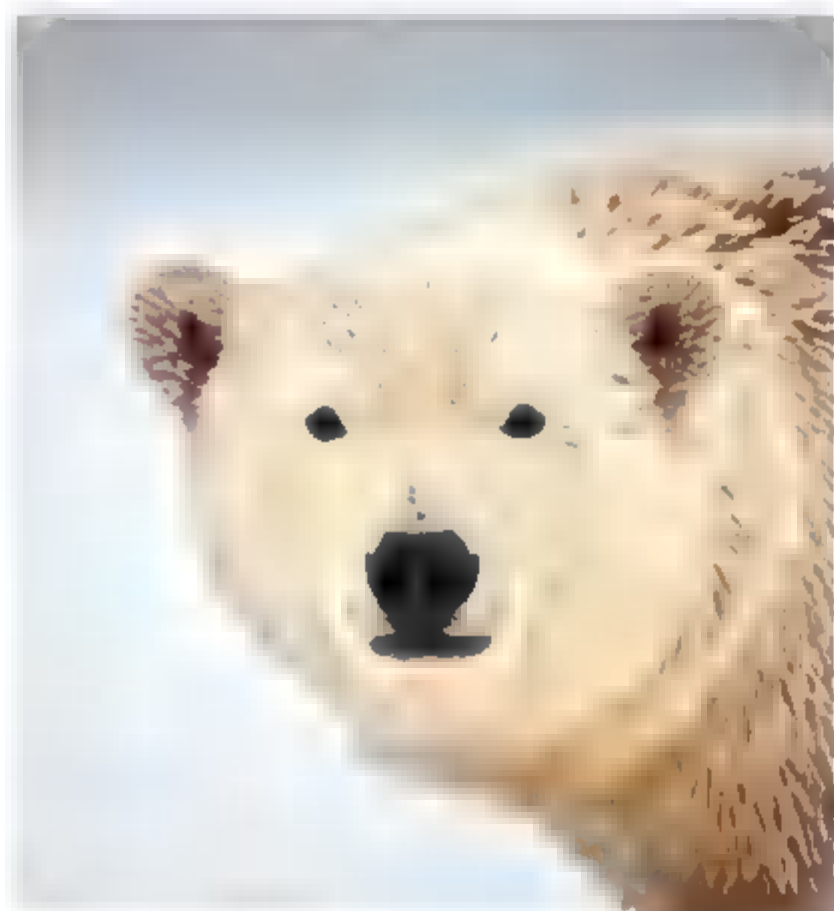
©2011 Rosetta Stone Ltd. All rights reserved. Offer limited to Rosetta Stone® Version 4 TOTAL® product purchases made directly from Rosetta Stone and cannot be combined with any other offer. Prices do not include taxes and are subject to change without notice. Coaching, interactive gaming and other online services require online access and are offered on a subscription basis for a specified term. Online services must be begun within 3 months of purchase or are subject to forfeiture. Offer valid through 8/31/2011. *Guarantee is limited to Version 4 TOTAL product purchases made directly from Rosetta Stone and does not include return shipping. Guarantee does not apply to any online subscriptions purchased separately from the CD-ROM product or subscription renewals. All materials included with the product at time of purchase must be returned together and undamaged to be eligible for any exchange or refund.

CONSERVATION



Polarizing Move For the first time polar bears in the U.S. have their own critical habitat. The 187,157-square-mile swath around Alaska is mostly offshore, where roughly 3,500 *Ursus maritimus* dwell on sea ice—and large oil deposits may lurk. Set last fall, the Interior Department designation means all future drilling plans will be federally scrutinized (existing structures are exempt). It also protects barrier islands and the coastline where more mother bears are denning as sea ice melts.

So far, reactions have been mixed. The state of Alaska and Alaska Native corporations, which rely heavily on oil and gas dollars, say the red tape and the habitat's vast size will spell huge revenue losses. Environmentalists cheer the move but fear it won't be enforced. To save polar bears, they say, list them as endangered, not threatened. That would bolster legal protections and leave more room to tackle the chief threat to the animals' territory: the greenhouse gas emissions causing climate change. —Jeremy Berlin



The critical habitat established to protect Alaska's polar bears is the largest of its kind in the United States.



Fueling Good 

PUMP GAS AT CITGO, AND ALL KINDS OF GOOD THINGS ARE SET IN MOTION.

Every CITGO station is locally owned and fuels good things in our communities. By helping people get on their way. And providing jobs that support families and other local businesses. CITGO owners use their own fuel to fund the impact their stations have. The CITGO stores we fuel the common good in every way. From supporting the high school band and other charities, and providing local organizations with fuel for their own good works. Now that's a lot of good.

Chris
CITGO Owner
Climax, NC



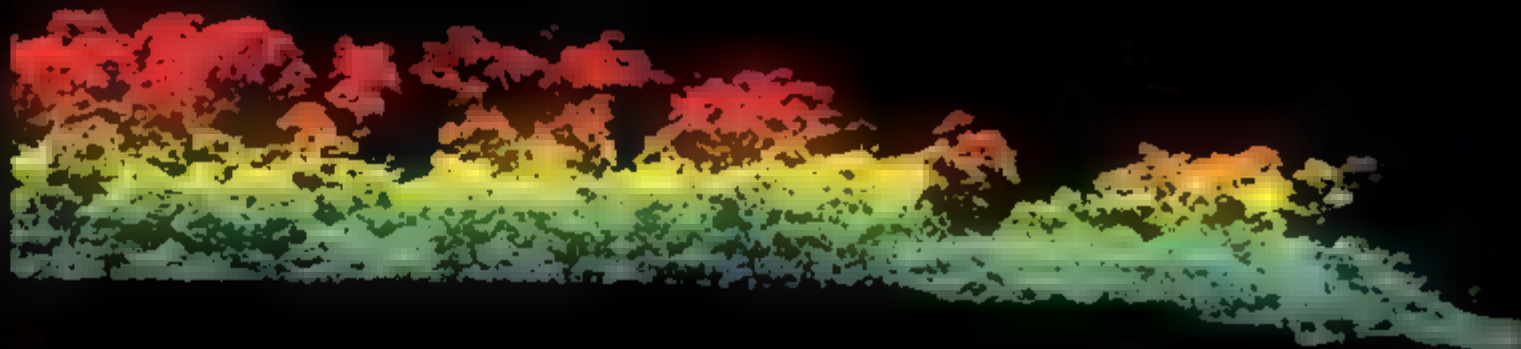
Learn more about the local impact CITGO has in your community at FuelingGood.com.

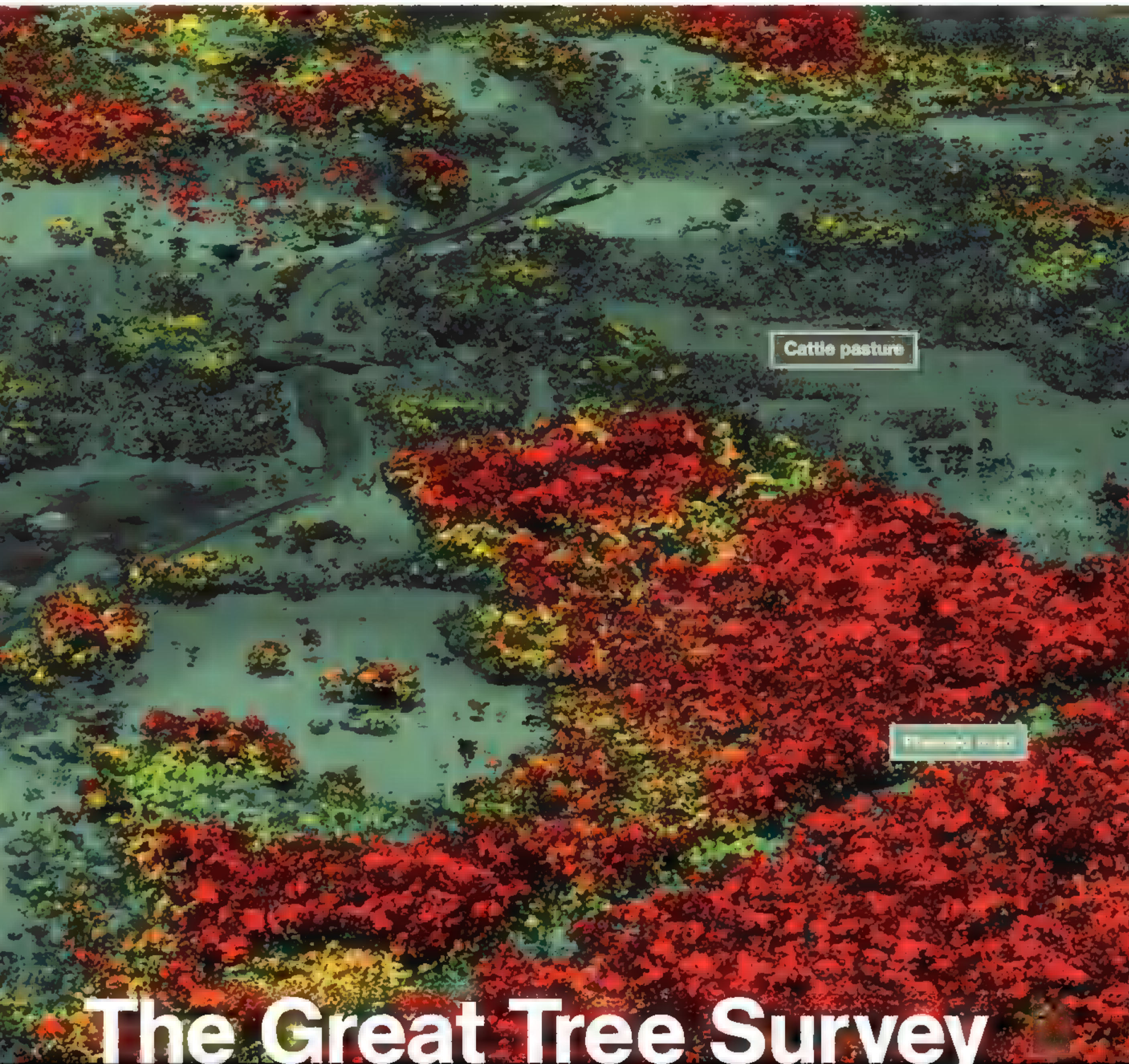


An aerial map of a rapidly changing part of Peru, made by bouncing laser light off treetops, distinguishes primary, old-growth forest—with tall trees holding a lot of carbon—from secondary and logged forest.

Canopy height

- 79 ft
- 59 ft
- 39 ft
- 20 ft
- 3 ft





The Great Tree Survey

A new way of measuring the carbon in forests may help keep them from being cut down.

THE NEWS FROM THE PLANET'S FORESTS has been surprisingly good lately, at least compared with the news of a decade or two ago. Globally, according to a United Nations report that came out last year, the rate at which forests are destroyed—logged or cleared to make way for farms or mines—was nearly 20 percent lower from 2000 to 2010 than it had been in the previous decade. Huge tree-planting programs, especially in China, reduced the net loss of forest even further. But vast areas are still being slashed, mostly in the tropics, including each year a Switzerland-size area of previously undisturbed, ecologically precious “primary” forest. Most of those trees are burned, and the carbon stored in their (Continued)

Brazil Expedition Uncovers Thousands of Carats of Exquisite Natural Emeralds

Brandish a whopping 50 carats of genuine South American emeralds in a handcrafted new necklace design for less than \$200... and get a \$100 Stauer Gift Coupon!

Halfway into our ambitious trek through the rain forest I had to remind myself that "Nothing good comes easy." These days it seems that every business trip to Brazil includes a sweltering hike through overgrown jungles, around cascading waterfalls and down steep rock cliffs. But our gem broker insisted it was worth the trouble. To tell you the truth, for the dazzling emeralds he delivered, I'd gladly go back to stomping through jaguar country.

Now our good fortune is your great reward. Don't miss this rare opportunity to own an impressive 50 carat strand of genuine South American emeralds for under \$200. And for a limited time, we'll sweeten every necklace order with a \$100 Stauer Gift Coupon!

Faced with this embarrassment of riches, our designer transformed this spectacular cache of large stones (each is over 8 carats average weight) into a stunning 50 ctw necklace of faceted emeralds set into .925 sterling silver. Each emerald is surrounded by delicate sterling silver rope work and filigree in the Bali-style. The 18" necklace dangles from a sterling silver chain that fastens with a secure double-sided shepherd's hook clasp.

What is the source of our emerald's timeless appeal?

The enchanting color of the Stauer *Carnaval* Faceted Emerald Necklace comes from nature's chemistry. Our polished and faceted, well-formed natural emeralds are immediately recognized as something special. Indeed, when we evaluated these emeralds, color was the most important quality factor. Today, scientists tell us that the human eye is more sensitive to the color green than to any other. Perhaps that is why green is so soothing to the eye, and why the color green complements every other color in your wardrobe.

Emeralds are, by weight, the most valuable gemstone in the world.

Now you can wear genuine emeralds and feel great about knowing that you were able to treat yourself to precious gems without paying a precious price. A 100+ carat emerald necklace found on Rodeo Drive or 5th Avenue could cost well over \$250,000...but not from Stauer. Wear and admire the exquisite Stauer *Carnaval* Faceted Emerald Necklace for 30 days.

Special Offer
Receive a \$100 Stauer Gift Coupon with the purchase of this necklace. **Yes, you read that right.**

"You will rarely find an emerald necklace with 50 carats and certainly not at this price!"

— JAMES T. FENT, Stauer GIA Graduate Gemologist

If for any reason you are not dancing the Samba with pure satisfaction after receiving your faceted emerald necklace, simply return it to us for a full refund of the purchase price. But we're confident that when you examine this stunning jewelry, you'll be reminded of the raw beauty of the Amazon rain forests mixed with the flash and dazzle of the exotic Carnival in Rio de Janeiro. **Call Today. This cache of genuine emeralds is extremely limited.**

- A. *Carnaval* Necklace (50 ctw) **\$199**
 - B. *Carnaval* Ring (13 ctw) **\$129**
 - C. *Carnaval* Earrings (20 ctw) **\$129**
 - D. *Carnaval* Bracelet (50 ctw) **\$189**
- Carnaval* Collection (83 ctw) ~~\$437~~**
Includes necklace, ring and earrings.
Now only \$299 Save \$158!

***Special Offer—**Receive a \$100 Stauer Gift Coupon with the purchase of each individual *Carnaval*.

1-888-306-7179

Promotional Code FEN391-04
Please mention this code when you call.

Stauer®

14101 Southcross Drive W.,
Dept. FEN391-04
Burnsville, Minnesota 55337

www.stauer.com

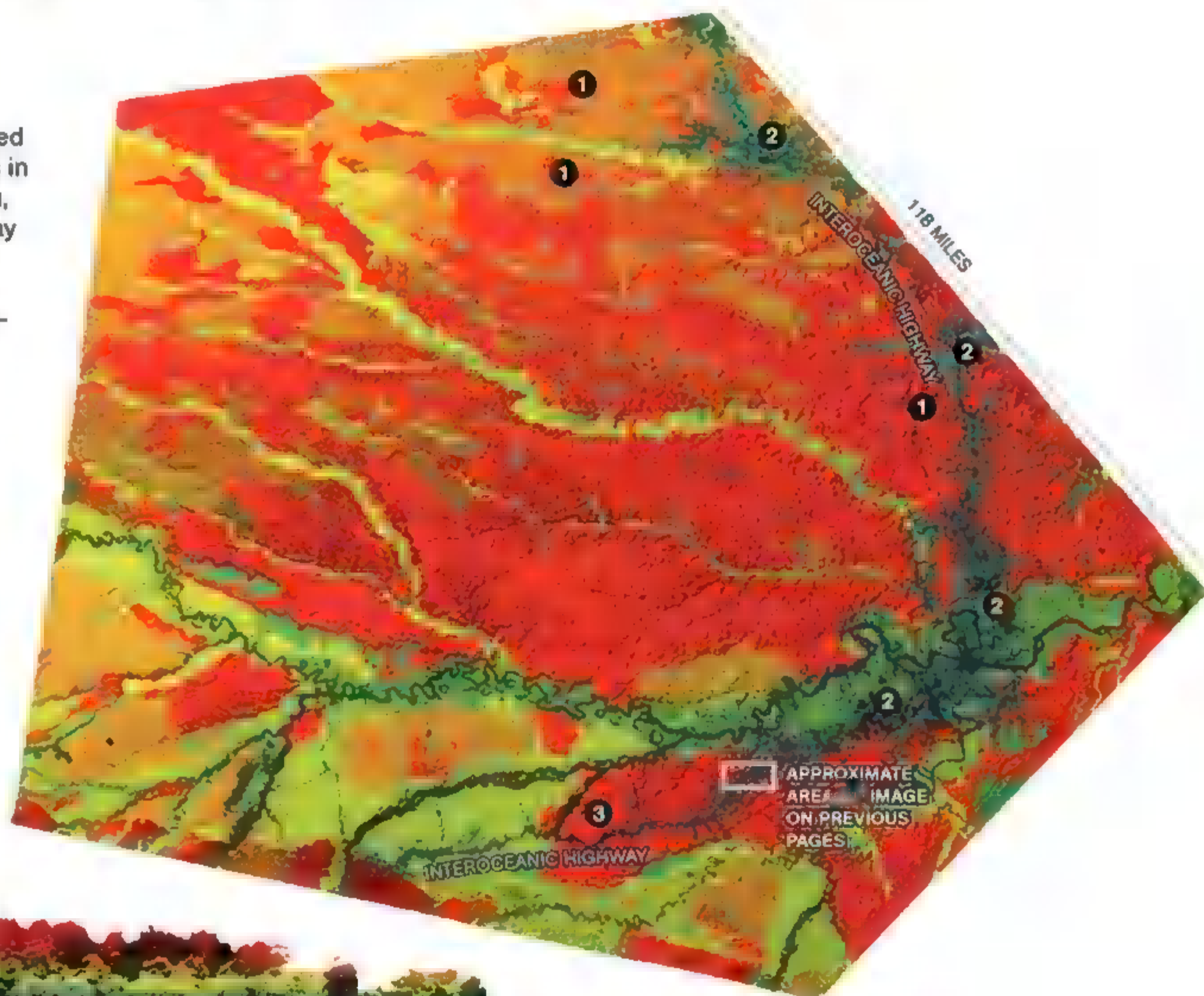
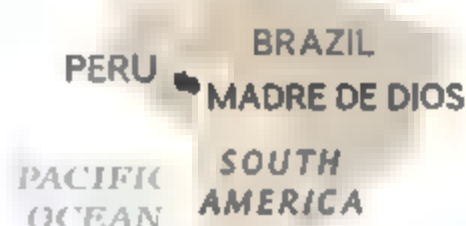
A.
50 ctw of genuine emeralds. Enlarged to show details.



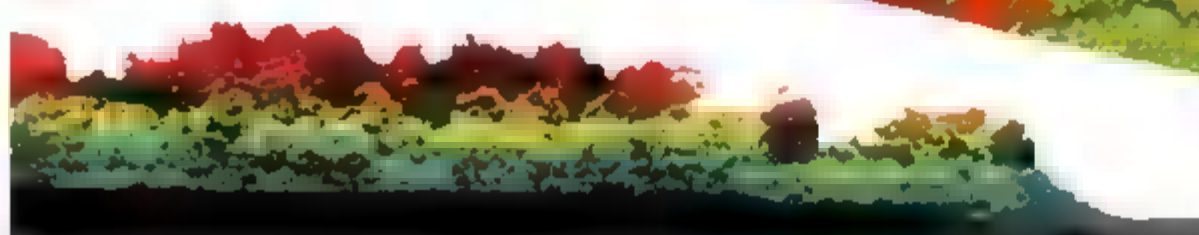
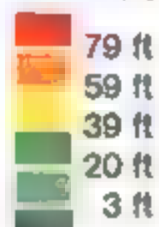
THE BIG IDEA

SURVEY AREA

Researchers surveyed 16,900 square miles in Madre de Dios, Peru, where a new highway linking Brazil to the Pacific is encouraging development—and deforestation.



Canopy height



Causes of Deforestation

- 1 Selective logging and other forestry activity
- 2 Ranching, roadbuilding, and other construction
- 3 Artisanal gold mining

wood literally goes up in smoke. Rough estimates indicate deforestation still contributes around four billion tons of planet-warming CO₂ to the atmosphere each year, an eighth of the human total.

If storing carbon in trees had an economic return, both climate and forests—and the tremendous diversity of life in forests—would be better off. At the UN-sponsored climate conference in Cancún, Mexico, last December, delegates reached agreement on a long-debated program known as REDD, short for Reducing Emissions from Deforestation and Forest Degradation. The basic idea is for rich countries to pay to preserve forests in poor ones, which can be cheaper than reducing their own carbon emissions.

One obstacle has been the lack of a reliable way of measuring how much carbon is stored in different forests without inspecting every acre from the ground. That's where the maps shown here fit in. They were made by a team led by Gregory Asner, a tropical ecologist with the

Carnegie Institution. Satellites, Asner explains, can track forest loss, but not whether it's primary forest or secondary regrowth—whether it consists of huge, old-growth trees or of scrawny saplings that store less carbon.

Asner's team can now do that by surveying the forest from a plane with lidar, a laser-ranging instrument similar to radar. The device shoots an infrared laser pulse toward the ground 100,000 times a second and records how long it takes to reflect back. Some of the light bounces off the forest canopy, but some makes it all the way to the ground. "It's kind of like an MRI," says Asner. "We can figure out not just the height of the canopy, but also the 3-D structure of the forest," and thus how much carbon it's storing. You still need on-the-ground measurements to spot-check the lidar, Asner says, and satellites to get the big picture. But all three together just might offer a way of keeping carbon trading honest—and tropical forests intact. —Michael Lemonick





*"Each day we are witness to a miracle
and thought," says Australian
marine scientist Charlie Veron, here
admiring a garden of stony corals on
the northern Great Barrier Reef.
"But I know there is fragility in their
existence. I fear what lies ahead."*

A FRAGILE EMPIRE

From tiny coral polyps grew a marvel: Australia's Great Barrier Reef. Could it all come crumbling down?



Wide ribbons of coral, visible from space, divide Australia's east coast, divide the continental shelf, and lead to deep, darker waters farther out to sea. The peculiar humphead wrasse (left) is among the reef's many thousands of species.

© 2016 PBS. ALL RIGHTS RESERVED.







Rhythmic currents in Challenger Bay push and pull a school of diagonal-banded sweetlips. Members of the grunt family, these fleshy-lipped fish feed at night, plucking invertebrates from the sandy sea bottom.

PLECTORHINCHUS LINEATUS

By Jennifer S. Holland

Photographs by David Doubilet

NOT FAR BENEATH THE SURFACE OF THE CORAL SEA, WHERE THE GREAT BARRIER REEF LIVES,

parrotfish teeth grind against rock, crab claws snap as they battle over hiding spots, and ■ 600-pound grouper pulses its swim bladder to announce its presence with a muscular *whump*. Sharks and silver jacks flash by. Anemone arms flutter and tiny fish and shrimp seem to dance a jig as they guard their nooks. Anything that can't glom on to something rigid is tugged and tossed by each ocean swell.

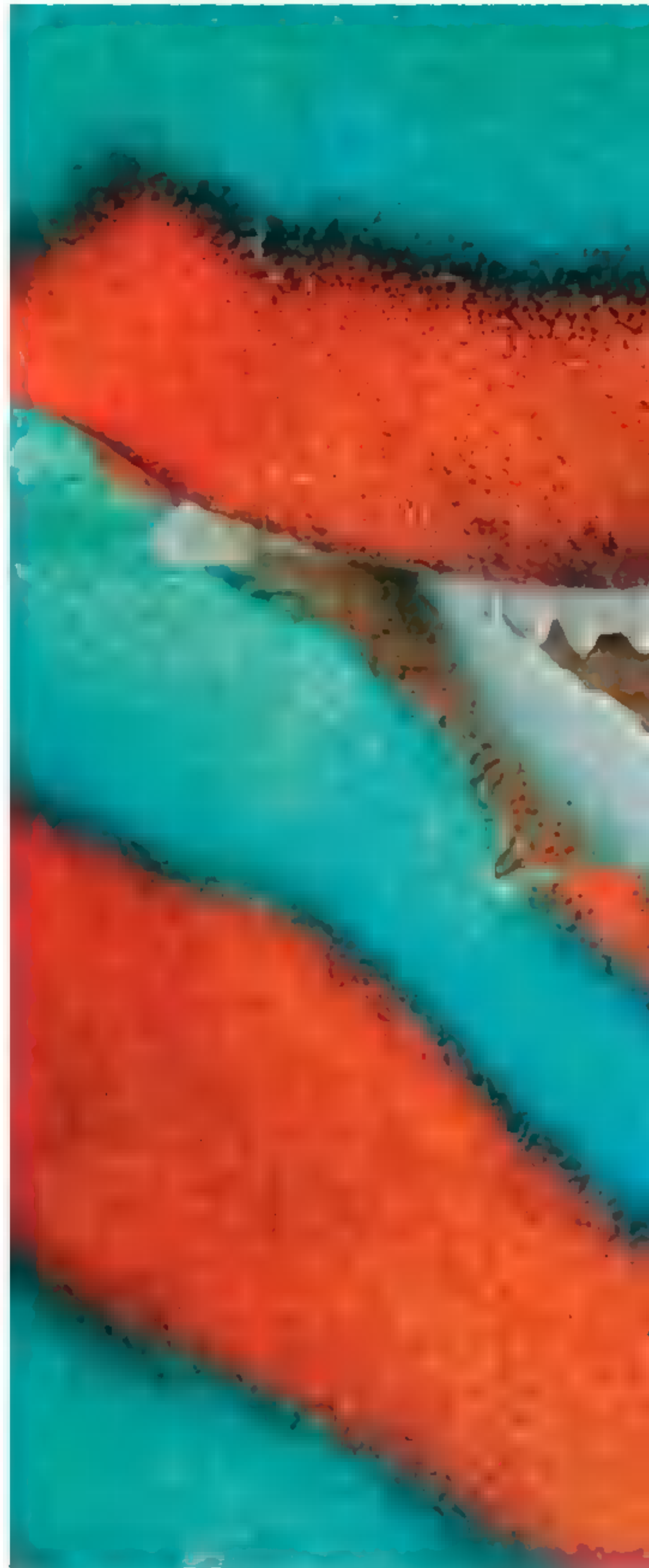
The reef's sheer diversity is part of what makes it great. It hosts 5,000 types of mollusks, 1,800 species of fish, 125 kinds of sharks, and innumerable miniature organisms. But the most riveting sight of all—and the main reason for World Heritage status—is the vast expanse of coral, from staghorn stalks and wave-smoothed plates to mitt-shaped boulders draped with nubby brown corals as leathery as saddles. Soft corals top hard ones, algae and sponges paint the rocks, and every crevice is a creature's home. The biology, like the reef, transforms from the north—where the reef began—to the south. The shifting menagerie is unmatched in the world.

Time and tides and a planet in eternal flux brought the Great Barrier Reef into being millions of years ago, wore it down, and grew it back—over and over again. Now all the factors that let the reef grow are changing at a rate the Earth has never before experienced. This time the reef may degrade below a crucial threshold from which it cannot bounce back.

WEST MEETS REEF Europeans were introduced to the Great Barrier Reef by British explorer Capt. James Cook, who came upon it

quite by accident. On a June evening in 1770, Cook heard the screech of wood against stone; he couldn't have imagined that his ship had run into the most massive living structure on Earth: more than 10,000 square miles of coral ribbons and isles waxing and waning for some 1,400 winding miles.

Cook's team had been exploring the waters offshore of what is now Queensland when the H.M.S. *Endeavour* became trapped in the





labyrinth. Not far beneath the surface, jagged towers of coral tore into the ship's hull and held the vessel fast. As timbers splintered and the sea poured in, the crew arrived on deck "with countenances which sufficiently expressed the horrors of our situation," Cook later wrote in his diary. Captain and crew were able to limp to a river mouth to patch their vessel.

Aborigines had lived in the region for thousands of years before Europeans hit the rocks.

The clownish grin of a bridled parrotfish reveals its power tools: grinding teeth used to scrape algae from rock. Though sometimes destructive to individual corals, the fish's efforts are mostly beneficial. Without them, algal growth could smother the reef.

SCARUS FRENATUS

IF THE REEF'S MAIN CHUNKS WERE
PLUCKED FROM THE SEA AND LAID OUT
TO DRY, THE ROCK COULD COVER
ALL OF NEW JERSEY,
WITH CORAL TO SPARE.

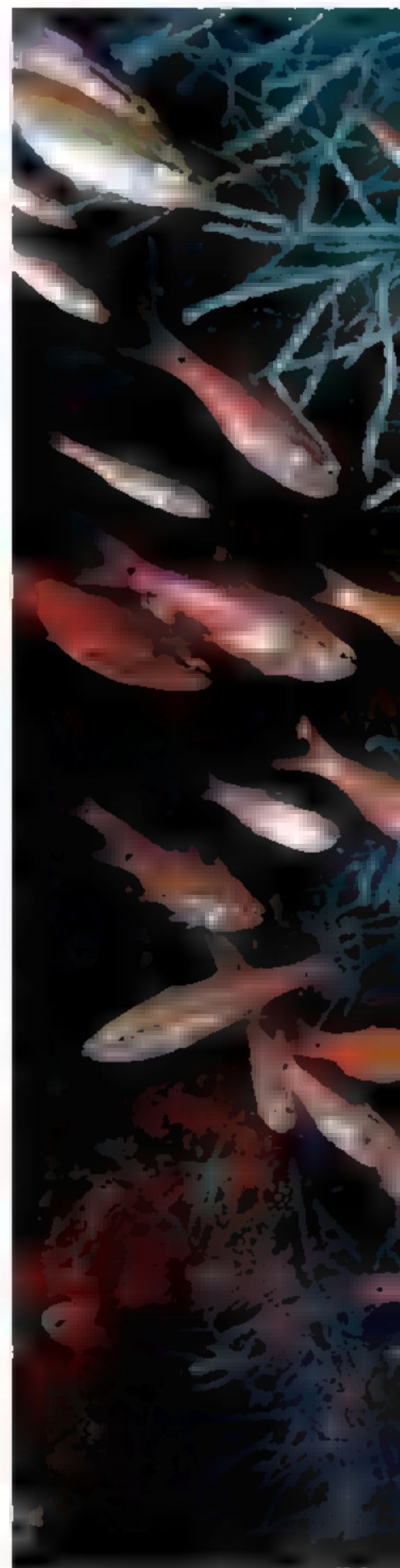
Culturally, the reef has been a rich part of the landscape for Aboriginal and Torres Strait Islander peoples, who have canoed it and fished it and shared myths about its creatures for generations. But historians aren't sure how deep their knowledge went of the reef's geology and animal life. A few decades after Cook's run-in with the behemoth beneath the sea, English cartographer Matthew Flinders—who also had a mishap or two while “threading the needle” among the reefs—gave the entity its name, inspired by its size. All told, if the reef's main chunks were plucked from the sea and laid out to dry, the rock could cover all of New Jersey, with coral to spare.

EXPANSION AND EROSION This mammoth reef owes its existence to organisms typically no bigger than a grain of rice. Coral polyps, the reef's building blocks, are tiny colonial animals that house symbiotic algae in their cells. As those algae photosynthesize—using light to create energy—each polyp is fueled to secrete a “house” of calcium carbonate, or limestone. As one house tops another, the colony expands like a city; other marine life quickly grabs on and spreads, helping cement all the pieces together.

Off Australia's eastern edge, conditions are ripe for this building of stone walls. Corals grow best in shallow, clear, turbulent water with lots of light to support photosynthesis. Millions of polyp generations later, the reef stands not as a singular thing but as a jumble whose shapes, sizes, and life-forms are determined by where in the ocean they lie—how close to shore, for example—and what forces work on them, such

Cardinalfish zip by a hawksbill turtle as it rests among feathery invertebrates called hydroids. Illegally harvested for their shells, hawksbills are declining globally. Some 3,000 nest along the northern Barrier Reef.

ERETMOCHELYS IMBRICATA (TURTLE);
APOGON LEPTOFASCIATUS (FISH);
LYTOCARPUS SP. (HYDROID)



as heavy waves. Go far enough from the coast, where the light is low and the waters are deeper, and there's no reef at all.

“In the Great Barrier Reef, corals set the patterns of life from end to end,” says Charlie Veron, coral expert and a longtime chief scientist for the Australian Institute of Marine Science. With over 400 species in the region, “they structure the entire environment; they're the habitat for everything else here.” The perfect temperature, clarity, and currents enable plate corals, for example, to increase in diameter up to a foot

David Doubilet divided his time between the Great Barrier Reef's remote north and its touristed south and central areas. Jennifer S. Holland is a staff writer.



a year. The reef continuously erodes as well, worn down by waves, ocean chemistry, and organisms that eat limestone. This vanishing act is far slower than the constant building up; still, as much as 90 percent of the rock eventually dissipates into the waters, forming sand. So the living veneer of this reef, the part a diver sees, is ever changing.

And the layers beneath are relatively young, geologically speaking, at less than 10,000 years. The reef's true beginnings go back much further. Closer to 25 million years ago, Veron says, as Queensland edged into tropical waters with the movement of the Indo-Australian tectonic plate, coral larvae began riding south-flowing currents from the Indo-Pacific,

grabbing footholds wherever they could. Slowly, rocky colonies grew and spread along the sea-floor flush with diverse marine life.

A ROCKY COURSE Since the reef first found footing, ice ages have come and gone, tectonic plates have crept forward, and ocean and atmospheric conditions have fluctuated wildly. The reef has seen many iterations—expanding and eroding, being defaced and reinhabited at nature's whim.

"A history of the Great Barrier Reef," Veron says, "is a catalog of disasters" caused by planetary chaos. But they are disasters from which the reef has always recovered.

Today new disasters endanger the reef, and

AUSTRALIA'S MONUMENTAL REEF

The Great Barrier Reef stretches more than 1,400 miles and houses 70 biological zones. Different reef types, highlighted in the graphic at right, are determined by proximity to the coast and to deep water, as well as by forces of nature that act upon them. As a whole, the reef's size and diversity help shove off massive icebergs, absorb heat and living structures that pollute the

FLINDERS GROUP NATIONAL PARK

Bathurst Bay

Pipon Island

Tydeman Reef

Cape Melville

South Warden Reef

North Bay Point

Smitzer Reef

COMBE ISLAND NATIONAL PARK

Barrow Point

Muskech Point

Snake Reef

FRINGING REEFS

hug coasts, spreading over low-lying rock foundations. Sediment can cover and choke them. Pollution runoff is another threat.

Linnet Reef

Martin Reef

Plattery Harbour

Cape Plattery

THREE ISLANDS GROUP NATIONAL PARK

Helsdon Reef

Two Islands

Three Islands

Pasco Reef

Long Reef

Forrester Reef

Mackay Reefs

MID-SHELF REEFS

are rounded patches that emerge from the continental shelf. Some develop interior lagoons. Others are topped by sandy or forested islands.

Swinger Reef

Startle Reefs

Mara Reef

Cape Bedford

Nob Point

Lark Reef

Williamian Reefs

Dawson Reef

Egret Reef

Innamet Reef

Unnamed reefs

Osterlund Reef

Vicki Harriot Reef

Unnamed reefs

Ribbon #5 Reef

Rosser Reef

Ribbon #4 Reef

Emily Reef

Unnamed reef

Ribbon #3 Reef

RIBBON REEFS

follow Ice Age coastlines at the edge of the continental shelf. Exposed, they bear the brunt of ocean storms.

Ribbon #2 Reef

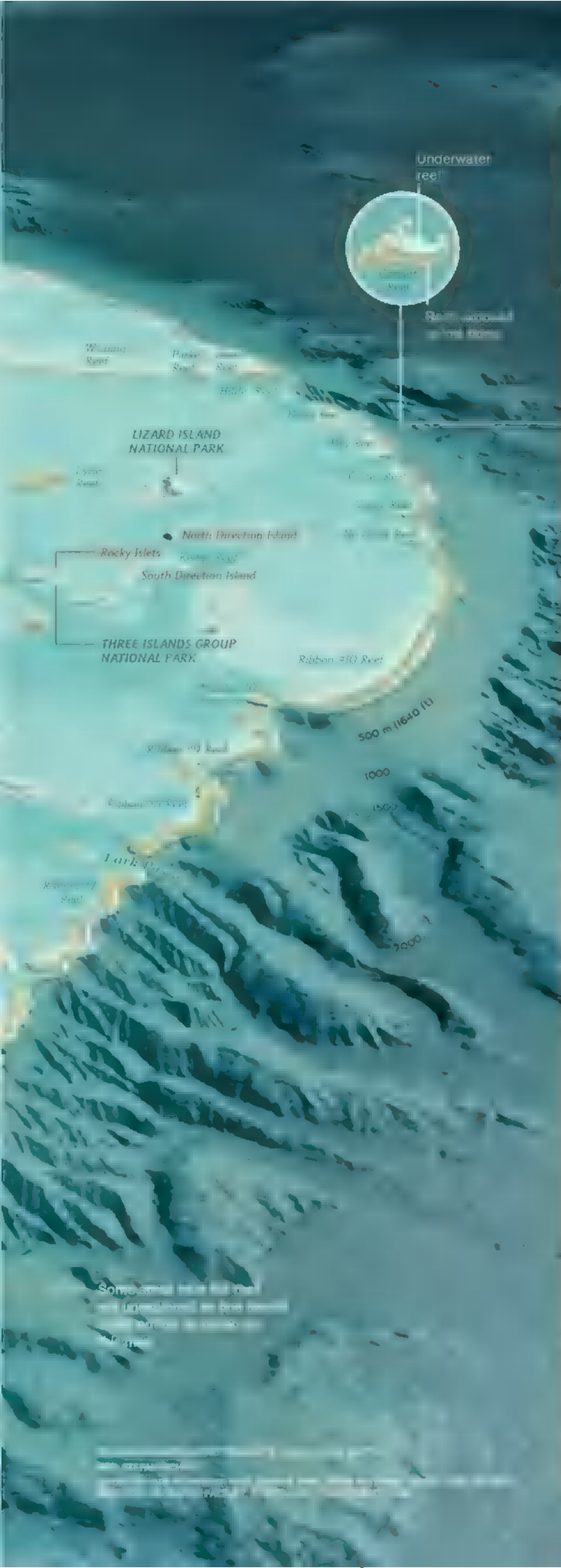
Edge of continental shelf

500 m


1000

1500

Irene Reef







*Following a full-moon night or two each year, immobile stony corals like *Acropora millepora* release egg and sperm bundles simultaneously in an orgy of mass spawning. Fertilized eggs, once they have settled near and far, are the stuff of new colonies.*

THE REEF'S HISTORY IS A
CATALOG OF DISASTERS
FROM WHICH IT HAS
ALWAYS RECOVERED.

the prospect for recovery is uncertain. The relatively quick shift in the world's climate, scientists say, appears to be devastating for reefs. In corals, warming temperatures and increased exposure to the sun's ultraviolet rays lead to a stress response called bleaching—when the colorful algae in coral cells become toxic and are expelled, turning the host animals skeletal white. Fleeshy seaweeds may then choke out the remains.

Major bleaching in the Great Barrier Reef and elsewhere in 1997-98 was linked to a severe El Niño year and record-high sea-surface temperatures—in some spots 3°F higher than normal. Another round began in 2001 and again in 2005. By 2030, some reef experts say, these destructive episodes will occur every year.

Heat is also implicated in a 60-year decline in ocean phytoplankton—the microscopic organisms that not only gobble greenhouse gases but also feed, directly or indirectly, almost every other living thing in the sea. Reef fish, too, respond to warmer waters—sometimes with bolder, more aggressive behavior toward both predators and prey. Changes in sea level, either up or down, have a dire impact as well, exposing shallow corals to too much sun or drowning them in deeper water, where they're hidden from the light.

A more immediate concern is massive flooding in Australia that earlier this year sent huge plumes of sediment and toxin-laden waters onto the reef off Queensland. The full harm to marine life won't be clear for years, but long stretches of the Great Barrier Reef could experience disastrous die-offs.

And then there's the acid test.

Reef ecosystems worldwide took a pounding

Drawn to the smell of a dead sperm whale, a ten-foot tiger shark arrives at the edge of the reef to feast on floating flesh. Bits of food left undevoured will fall to feed the reef's tinier residents.

GALEOCERDO CUYER

during each of Earth's five mass extinctions, the first about 440 million years ago. Greenhouse gases spiked naturally over the millennia, and Aussie biologist Veron says massive spewing of carbon dioxide during periods of heavy volcanic activity was likely a big player in coral decimation, notably the most recent mass extinction some 65 million years ago. At that time, oceans absorbed more and more of those greenhouse gases from the atmosphere, causing ocean acidity to rise. The lower pH—a sign of high levels of acidity—ultimately thwarted the ability of marine creatures to build their limestone shells and skeletons.

In some oceans this acidification is once again happening. The most vulnerable to acid's





corrosive bite are the fast-growing branching corals and vital calcium-excreting algae that help bind the reef. The more brittle the reef's bones, the more wave action, storms, diseases, pollutants, and other stresses can break them.

In ancient times many corals adapted to changing ocean acidity, says Veron, who paints a particularly bleak picture of the Barrier Reef's future. "The difference is there were long stretches in between; corals had millions of years to work it out." He fears that with unprecedented CO₂, sulfur, and nitrogen emissions by human industry, added to the increasing escape of methane as a result of Earth's melting ice, much of the reef will be nearly bereft of life within 50 years. What will be left? "Coral skeletons bathed in algal slime," he says.

EDGING FORWARD Of course, to the two million tourists who visit the reef each year, the promise of an underwater paradise teeming with life is still fulfilled. But the blemishes are there if you know where to look. The reef bears a two-mile-long scar from a collision with a Chinese coal carrier in April of last year. Other ship groundings and occasional oil spills have marred the habitat. Sediment plumes from flooding and nutrients from agriculture and development also do very real damage to the ecosystem. But Aussies aren't inclined to let the reef fall apart without a national outcry. The captain of the boat who took me diving put it this way: "Without the reef, there's nothing out here but a whole lot of salty water." To many locals, he adds, "the reef



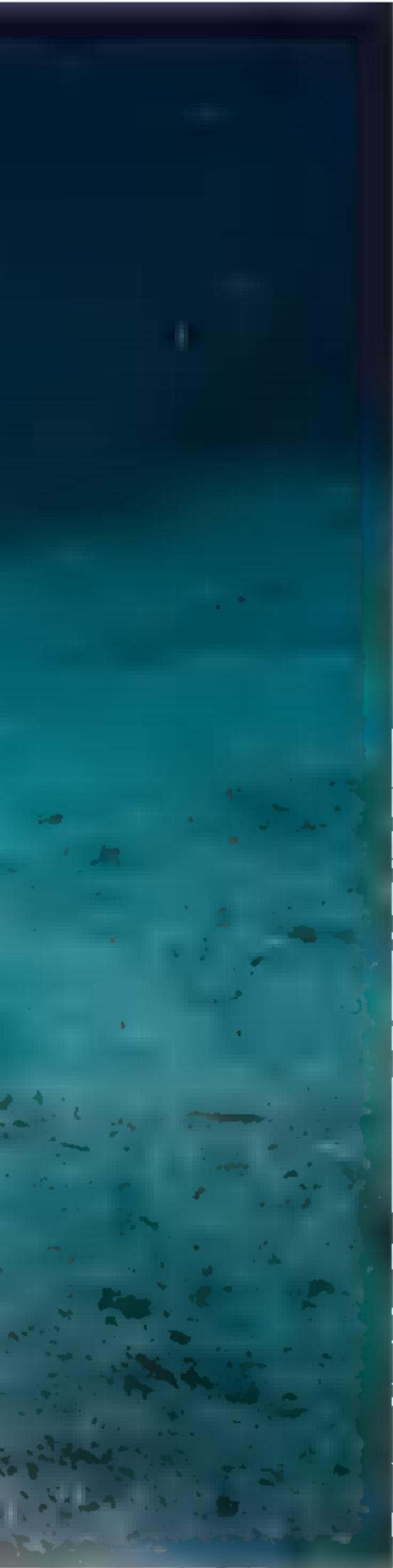
is a loved one whose loss is too sad to contemplate.” And it is also crucial economically: The visitors he motors to the reef’s edges provide more than one billion dollars annually for Australia’s books.

The challenge scientists face is to keep the reef healthy despite rapid change. “To fix a car engine, you need to know how it works,” says marine biologist Terry Hughes of James Cook University. “The same is true for reefs.” He and others have been investigating how these ecosystems function so that efforts to prevent damage can be doubly effective.

High on the to-do list: Determine the full impact of overfishing. Traditionally, commercial fishermen could work along the reef, even

after 133,000 square miles of ocean habitat was designated a marine park in 1975. But with rising concern about the big take, the Australian government in 2004 made a third of that area, in strategically placed zones, off-limits to all fishing—including for sport. The biological recovery has been bigger and faster than expected; within two years after the ban, for example, numbers of coral trout doubled on once heavily fished reef. Some scientists speculate that protective zones may also lead to declines in outbreaks of a devastating coral-eating sea star.

Scientists also want to know what makes specific corals extra tenacious during times of change. “We know some reefs experience much more stressful conditions than others,” says



A two-foot-long sea cucumber shoots thousands of ova into the current. These sea star kin—whose bumpy papillae are sensory—spawn en masse, boosting the chance of reproductive success.

HOLOTHURIA FUSCOPUNCTATA

reef ecologist Peter Mumby of the University of Queensland. “Looking at decades of sea temperature data, we can now map where corals are most acclimated to warmth and target conservation actions there.” He says understanding how corals recover from bleaching—and figuring out where new polyps are likely to grow—can help in designing reserves. Even the outspoken Veron acknowledges that coral survival is possible long-term if the onslaughts against reefs are halted—soon.

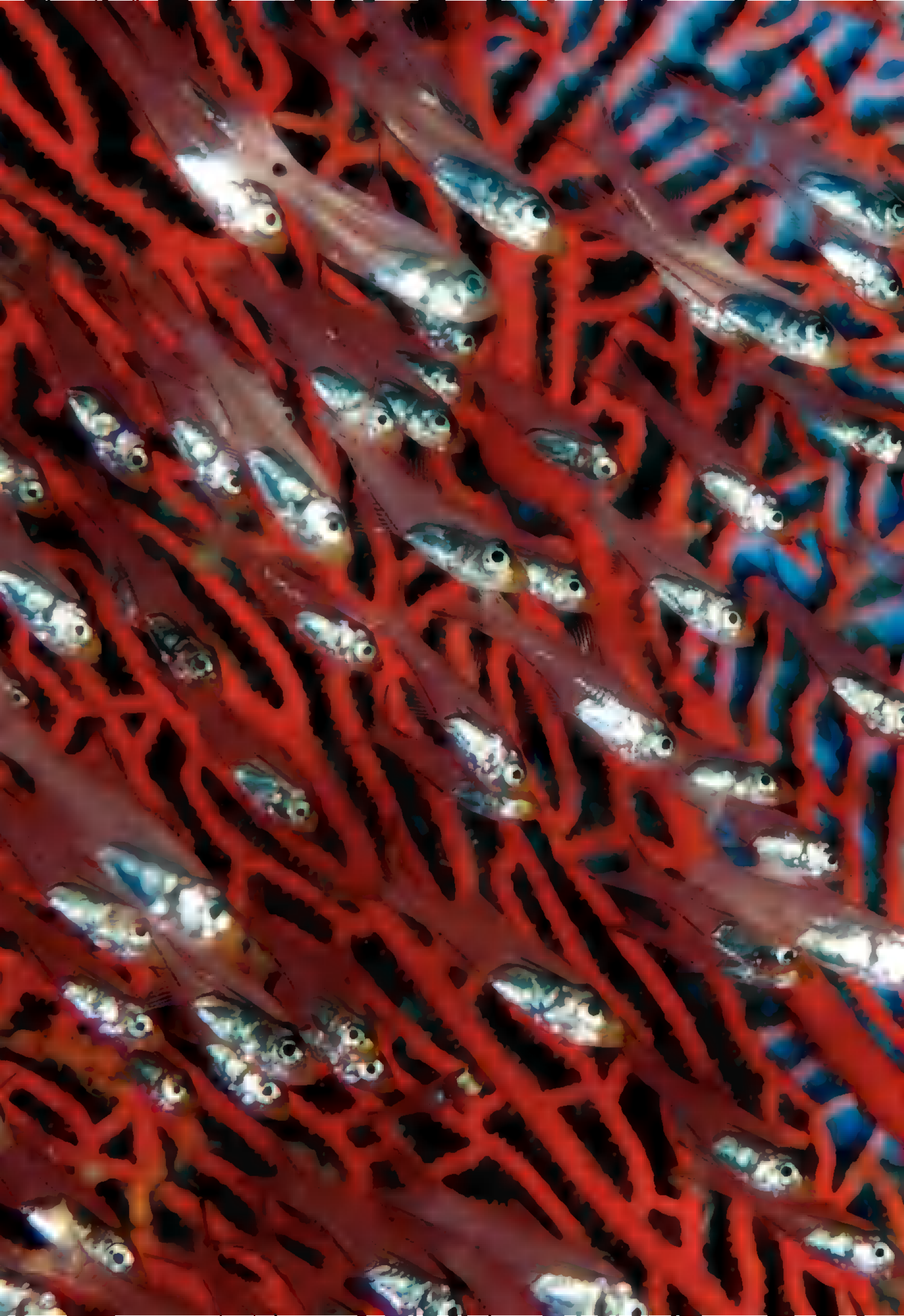
Nature has some safeguards of her own, including a genetic script for corals that may have helped them ride out past environmental disruptions. Many reef builders evolve through hybridization—when different species mix

SCIENTISTS WANT TO KNOW WHAT MAKES SPECIFIC CORALS EXTRA TENACIOUS IN TIMES OF CHANGE.

genes. As Veron puts it, “everything is always on its way to becoming something else.” On the reef, about a third of the corals reproduce in annual mass spawning. During such events, as many as 35 species on a single patch of reef release their egg and sperm bundles simultaneously, which means millions of gametes from genetically different parents mingle in a slick at the ocean surface. “This provides outstanding opportunities to produce hybrids,” explains marine biologist Bette Willis of James Cook University. Especially with climate and ocean chemistry in such flux, she says, hybridization can offer a speedy path to adaptation and hardiness against disease.

Indeed, one lesson is that despite today’s weighty threats, the Great Barrier Reef won’t easily crumble. It has, after all, toughed it out through catastrophic change before. And all kinds of marine life are around to help keep the reef whole. In studies conducted in 2007, scientists found that where grazing fish thrive, so do corals, especially in waters polluted with excess nutrients. “If you take away herbivores, say through overfishing, seaweed replaces corals,” says Hughes. If voracious vegetarians are protected, corals can prevail.

A human visitor to the reef can see the fish doing their vital job. In dappled afternoon light toward the reef’s northern tip, palatial walls of coral tower over a rare species of batfish, long finned and masked in black, that nibbles back strands of sargassum. And a school of parrotfish—fused teeth like wire cutters—chip away noisily at the rocks, where algae in mats of green and red have quietly taken hold. □





Shula parrotfish swim against a gorgonian sea fan on a northern reef. The soft coral's vivid color likely suggests toxicity to those passersby tempted to nibble at its branches.

PHOTOGRAPH BY SCOTT WILSON FOR NATIONAL GEOGRAPHIC

Tightly packed hard corals, mostly Acropora species, vie for space and energy-giving sunlight. Cairns. Though highly vulnerable to changing sea chemistry, these master builders of Indo-Pacific reefs have persisted for millions of years.







THE COMING STORM

The people of **BANGLADESH** have much to teach us about how a crowded planet can best adapt to rising sea levels. For them, that future is now.

BACKS TO THE WALL, BRICK WORKERS ABSORB THE STING OF A DRIVING RAIN ON THE TURAG RIVER WEST OF DHAKA.







OVERFLOWING WITH PEOPLE Taxi boats called *kheya nouka* cross the Buriganga River to Sadar Ghat, Dhaka's main boat terminal, providing transport in one of the world's most densely populated cities. Low-lying Dhaka is among those most at risk from rising seas.

SEEKING HIGHER GROUND | Maynard
pitch in to relocate buildings on Srajeag
atoll island in the Federated States of
Micronesia. (Associated Press)
2004, the island was hit by a
typhoon, destroying many
of the buildings.





BY DON BELT

PHOTOGRAPHS BY JONAS BENDIKSEN

WE MAY BE SEVEN BILLION SPECKS on the surface of Earth, but when you're in Bangladesh, it sometimes feels as if half the human race were crammed into a space the size of Louisiana. Dhaka, its capital, is so crowded that every park and footpath has been colonized by the homeless. To stroll here in the mists of early morning is to navigate an obstacle course of makeshift beds and sleeping children. Later the city's steamy roads and alleyways clog with the chaos of some 15 million people, most of them stuck in traffic. Amid this clatter and hubbub moves a small army of Bengali beggars, vegetable sellers, popcorn vendors, rickshaw drivers, and trinket salesmen, all surging through the city like particles in a flash flood. The countryside beyond is a vast watery floodplain with intermittent stretches of land that are lush, green, flat as a parking lot—and wall-to-wall with human beings. In places you might expect to find solitude, there is none. There are no lonesome highways in Bangladesh.

We should not be surprised. Bangladesh is, after all, one of the most densely populated nations on Earth. It has more people than geographically massive Russia. It is a place where one person, in a nation of 164 million, is mathematically incapable of being truly alone. That takes some getting used to.

So imagine Bangladesh in the year 2050, when its population will likely have zoomed to 220 million, and a good chunk of its current landmass could be permanently underwater.

SEVEN BILLION is a yearlong series on global population.





HOME FOR THE MOMENT Wading in a foot of water, the Uddin family gathers for a meal. They had recently moved their house to this location to escape flooding on an island near Kurigram. Soon after this photo was taken, the family planned to dismantle the house and move again.

That scenario is based on two converging projections: population growth that, despite a sharp decline in fertility, will continue to produce millions more Bangladeshis in the coming decades, and a possible multifeet rise in sea level by 2100 as a result of climate change. Such a scenario could mean that 10 to 30 million people along the southern coast would be displaced, forcing Bangladeshis to crowd even closer together or else flee the country as climate refugees—a group predicted to swell to some 250 million worldwide by the middle of the century, many from poor, low-lying countries.

“Globally, we’re talking about the largest mass migration in human history,” says Maj. Gen. Muniruzzaman, a charismatic retired army officer who presides over the Bangladesh Institute of Peace and Security Studies in Dhaka. “By 2050 millions of displaced people will overwhelm not just our limited land and resources but our government, our institutions, and our borders.” Muniruzzaman cites a recent war game run by the National Defense University in Washington, D.C., which forecast the geopolitical chaos that such a mass migration of Bangladeshis might cause in South Asia. In that exercise millions of refugees fled to neighboring India, leading to disease, religious conflict, chronic shortages of food and fresh water, and heightened tensions between the nuclear-armed adversaries India and Pakistan.

Such a catastrophe, even imaginary, fits right in with Bangladesh’s crisis-driven story line, which, since the country’s independence in 1971, has included war, famine, disease, killer cyclones, massive floods, military coups, political assassinations, and pitiable rates of poverty and deprivation—a list of woes that inspired some to label it an international basket case. Yet if despair is in order, plenty of people in Bangladesh didn’t read the script. In fact, many here are pitching another ending altogether, one

in which the hardships of their past give rise to a powerful hope.

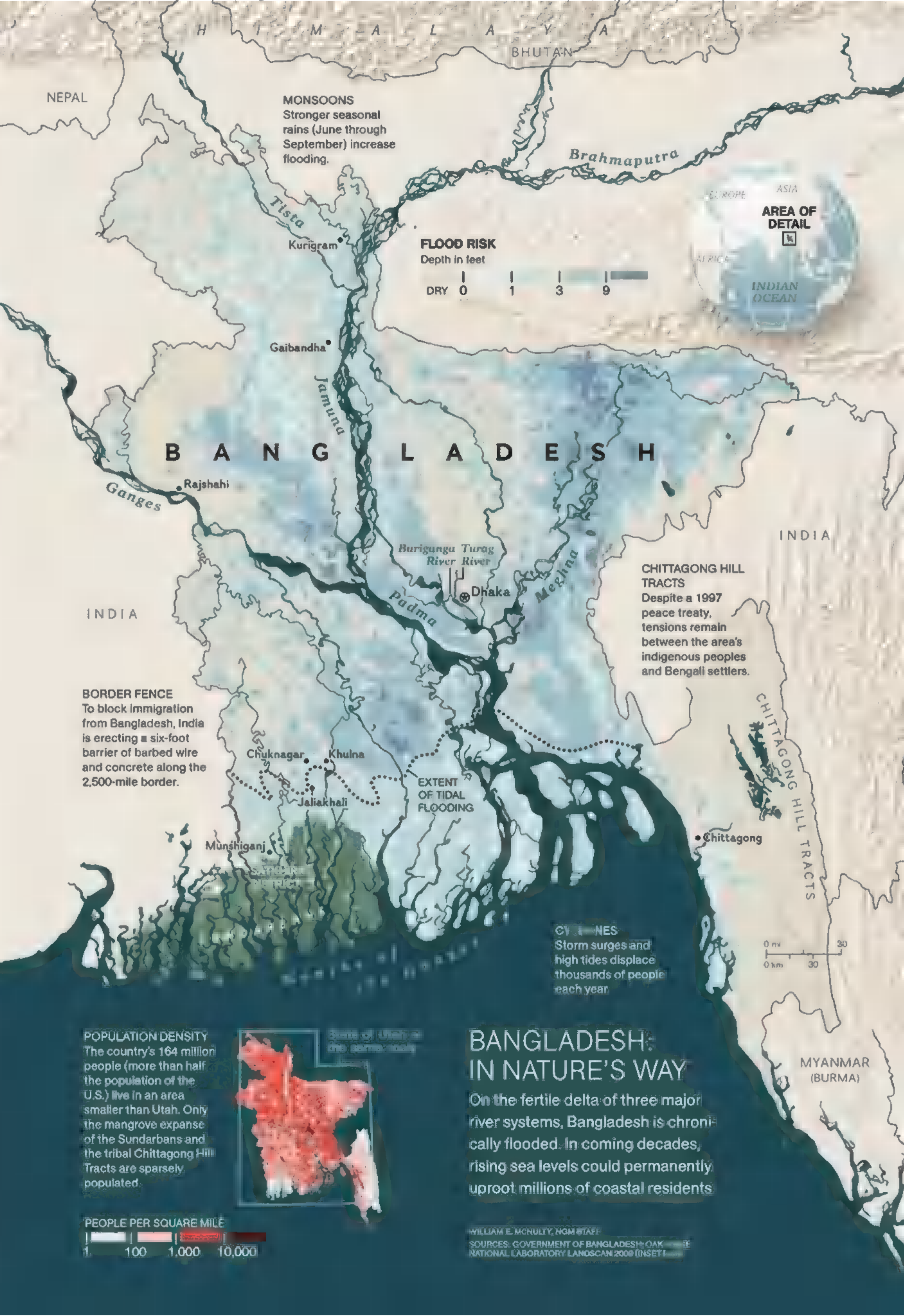
For all its troubles, Bangladesh is a place where adapting to a changing climate actually seems possible, and where every low-tech adaptation imaginable is now being tried. Supported by governments of the industrialized countries—whose greenhouse emissions are largely responsible for the climate change that is causing seas to rise—and implemented by a long list of international nongovernmental organizations (NGOs), these innovations are gaining credence, thanks to the one commodity that Bangladesh has in profusion: human resilience. Before this century is over, the world, rather than pitying Bangladesh, may wind up learning from her example.

MORE THAN A THIRD OF THE WORLD’S PEOPLE live within 62 miles of a shoreline. Over the coming decades, as sea levels rise, climate change experts predict that many of the world’s largest cities, including Miami and New York, will be increasingly vulnerable to coastal flooding. A recent study of 136 port cities found that those with the largest threatened populations will be in developing countries, especially those in Asia. Worldwide, the two cities that will have the greatest proportional increase in people exposed to climate extremes by 2070 are both in Bangladesh: Dhaka and Chittagong, with Khulna close behind. Though some parts of the delta region may keep pace with rising sea levels, thanks to river sediment that builds up coastal land, other areas will likely be submerged.

But Bangladeshis don’t have to wait decades for a preview of a future transformed by rising seas. From their vantage point on the Bay of Bengal, they are already facing what it’s like to live in an overpopulated and climate-changed world. They’ve watched sea levels rise, salinity infect their coastal aquifers, river flooding become more destructive, and cyclones batter their coast with increasing intensity—all changes associated with disruptions in the global climate.

On May 25, 2009, the people of Munshiganj, a village of 35,000 on the southwest coast, got a

Don Belt previously reported on the Indian subcontinent in September 2007 (Pakistan) and October 2008 (India). Jonas Bendixsen’s last feature was on the melting Himalayan glaciers (April 2010).



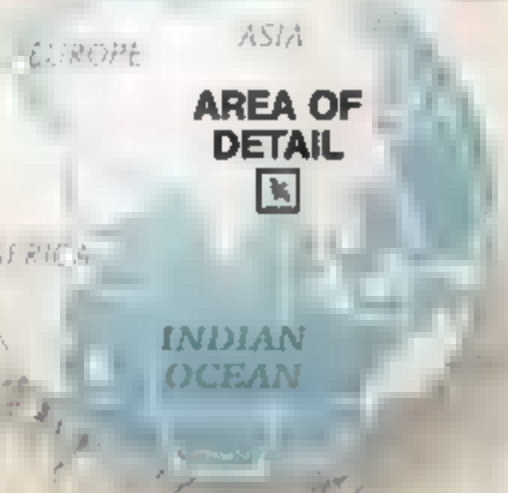
H I M A L A Y A S

BHUTAN

NEPAL

MONSOONS
Stronger seasonal rains (June through September) increase flooding.

Brahmaputra



AREA OF DETAIL

FLOOD RISK
Depth in feet



B A N G L A D E S H

INDIA

CHITTAGONG HILL TRACTS
Despite a 1997 peace treaty, tensions remain between the area's indigenous peoples and Bengali settlers.

BORDER FENCE
To block immigration from Bangladesh, India is erecting a six-foot barrier of barbed wire and concrete along the 2,500-mile border.

Buriganga Turag River
River

Dhaka

Padma

Meghna

Chuknagar

Khulna

Jaliakhali

EXTENT OF TIDAL FLOODING

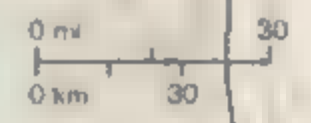
Munshiganj

SUNDERBANS

Chittagong

CHITTAGONG HILL TRACTS

CYCLONES
Storm surges and high tides displace thousands of people each year.



POPULATION DENSITY
The country's 164 million people (more than half the population of the U.S.) live in an area smaller than Utah. Only the mangrove expanse of the Sundarbans and the tribal Chittagong Hill Tracts are sparsely populated.



BANGLADESH: IN NATURE'S WAY

On the fertile delta of three major river systems, Bangladesh is chronically flooded. In coming decades, rising sea levels could permanently uproot millions of coastal residents.

MYANMAR (BURMA)

WILLIAM E. McNULTY, NGM STAFF
SOURCES: GOVERNMENT OF BANGLADESH; OAK NATIONAL LABORATORY LANDSCAM 2000 (INSET)

glimpse of what to expect from a multifeet rise in sea level. That morning a cyclone, called Aila, was lurking offshore, and its 70-mile-an-hour winds sent a storm surge racing silently toward shore, where the villagers, unsuspecting, were busy tending their rice fields and repairing their nets.

Shortly after ten o'clock Nasir Uddin, a 40-year-old fisherman, noticed that the tidal river next to the village was rising "much faster than normal" toward high tide. He looked back just in time to see a wall of brown water start pouring over one of the six-foot earthen dikes that protect the village—its last line of defense against the sea.

Within seconds water was surging through his house, sucking away the mud walls and everything else. His three young daughters jumped onto the kitchen table, screaming as cold salt water swirled around their ankles, then up to their knees. "I was sure we were dead," he told me months later, standing in shin-deep mud next to a pond full of stagnant green water the color of antifreeze. "But Allah had other plans."

As if by a miracle, an empty fishing boat swept past, and Uddin grabbed it and hoisted his daughters inside. A few minutes later the boat capsized, but the family managed to hang on as it was tossed by waves. The water finally subsided, leaving hundreds of people dead along the southwest coast and thousands homeless. Uddin and most of his neighbors in Munshiganj decided to hunker down and rebuild, but thousands of others set out to start a new life in inland cities such as Khulna and Dhaka.

THOUSANDS OF PEOPLE ARRIVE in Dhaka each day, fleeing river flooding in the north and cyclones in the south. Many of them end up living in the densely populated slum of Korail. And with hundreds of thousands of such migrants already, Dhaka is in no shape to take in new residents. It's already struggling to provide the most basic services and infrastructure.

Yet precisely because Bangladesh has so many problems, it's long served as a kind of laboratory for innovative solutions in the





CITY BOUND Under a rainy-season sky, migrants take the train back to Dhaka after visiting their home villages north of the capital. On either side are rice fields, healthy here but tainted by salinity farther south.



“We may be poor and appear disorganized, but we are not victims. And when things get tough, people here do what they’ve always done—they find a way to adapt and survive.” —Zakir Kibria, policy analyst

developing world. It has bounced back from crisis after crisis, proving itself far more resourceful than skeptics might have guessed. Dhaka is home to BRAC, the largest nonprofit in the developing world, held up as a model for how to provide basic health care and other services with an army of field-workers. Bangladesh also produced the global micro-finance movement started by Nobel Peace laureate Muhammad Yunus and his Grameen Bank.

And believe it or not, it’s a population success story as well. To whittle its high birthrate, Bangladesh developed a grassroots family-planning program in the 1970s that has lowered its fertility rate from 6.6 children per woman in 1977 to about 2.4 today—a historic record for a country with so much poverty and illiteracy. Fertility decline has generally been associated with economic improvement, which prompts parents to limit family size so they can provide education and other opportunities to their children. But Bangladesh has been able to reduce fertility despite its lack of economic development.

“It was very hard in the beginning,” says Begum Rokeya, 42, a government health worker in the Satkhira District who’s made thousands of home visits to persuade newlywed couples to use contraception and plan their family’s size. “This is a very conservative country, and men put pressure on women to have lots of children. But they began to see that if they immunized their kids, they wouldn’t need to have a bunch of babies just so a few would survive. They like the idea of fewer mouths to feed.”

Working in partnership with dozens of NGOs, Bangladesh has made huge strides in educating women and providing them with economic opportunities; female work-participation rates have doubled since 1995. Its economy is

growing, helped by its garment-export industry. And Bangladesh has managed to meet an important UN Millennium Development Goal: Infant mortality dropped dramatically between 1990 and 2008, from 100 deaths per 1,000 births to 43—one of the highest improvement rates among low-income countries.

In Dhaka such successes are dwarfed by the overwhelming poverty and the constant influx of villagers, prompting organizations, including BRAC, to get involved in helping village people figure out how to survive in a deteriorating environment. “Our goal is to prevent people from coming to Dhaka in the first place, by helping them adapt and find new ways of making a go of it in their villages,” says Babar Kabir, head of BRAC’s climate change and disaster management programs. “Big storms like Aila uproot them from the lives they know.”

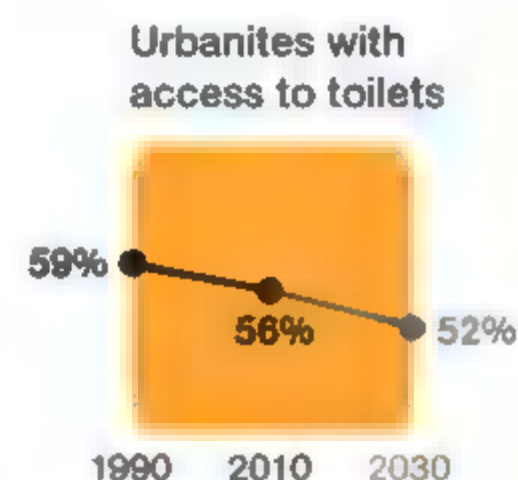
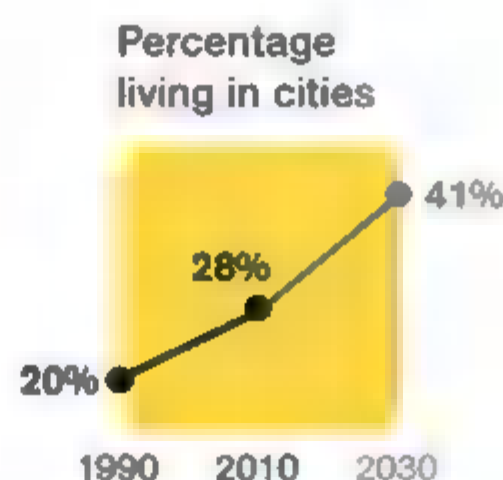
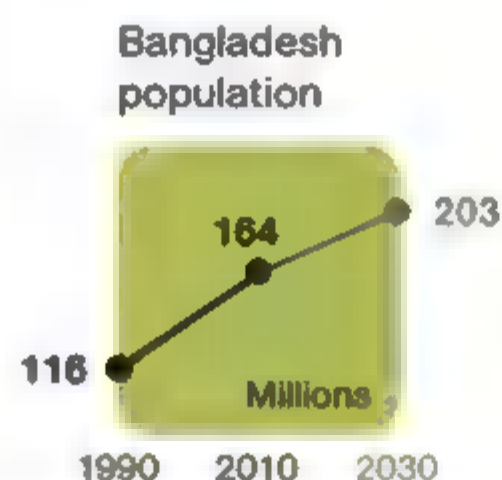
IBRAHIM KHALILULLAH HAS LOST TRACK of how many times he’s moved. “Thirty? Forty?” he asks. “Does it matter?” Actually those figures might be a bit low, as he estimates he’s moved about once a year his whole life, and he’s now over 60. Somehow, between all that moving, he and his wife raised seven children who “never missed a meal,” he says proudly. He’s a warm, good-natured man, with gray hair cut short and a longish gray beard, and everything he says has a note of joy in it.

Khalilullah is a *char* dweller, one of the hundreds of thousands of people who inhabit the constantly changing islands, or chars, on the floodplains of Bangladesh’s three major rivers—the Padma, Jamuna, and Meghna. These islands, many covering less than a square mile, appear and vanish constantly, rising and falling with the tide, the season, the phase of the moon, the

Urban Challenge

Sanitation systems are faltering as Bangladeshis crowd into cities.

HGM ART
SOURCE: WORLD HEALTH ORGANIZATION



rainfall, and the flow of rivers upstream. Char dwellers will set out by boat to visit friends on another char, only to find that it's completely disappeared. Later they will hear through the grapevine that their friends moved to a new char that had popped up a few miles downstream, built their house in a day, and planted a garden by nightfall. Making a life on the chars—growing crops, building a home, raising a family—is like winning an Olympic medal in adaptation. Char dwellers may be the most resilient people on Earth.

There are tricks to living on a char, Khalilullah says. He builds his house in sections that can be dismantled, moved, and reassembled in a matter of a few hours. He always builds on a raised platform of earth at least six feet high. He uses sheets of corrugated metal for the outside walls and panels of thatch for the roof. He keeps the family suitcases stacked neatly next to the bed in case they're needed on short notice. And he has documents, passed down from his father, that establish his right to settle on new islands when they emerge—part of an intricate system of laws and customs that would prevent a million migrants from the south, say, from ever squatting on the chars. His real secret, he says, is not to think too much. "We're all under pressure, but there's really no point to worry. This is our only option, to move from place to place to place. We farm this land for as long as we can, and then the river washes it away. No matter how much we worry, the ending is always the same."

Even in the best of times, it's a precarious way of life. And these are not the best of times. In Bangladesh climate change threatens not just the coast but also inland communities like Khalilullah's. It could disrupt natural cycles of precipitation, including monsoon rains and the

Tibetan Plateau snowfall, both of which feed the major rivers that eventually braid their way through the delta.

But precisely because the country's geography is prone to floods and cyclones, Bangladeshis have gotten a head start on preparing for a climate-changed future. For decades they have been developing more salt-resistant strains of rice and building dikes to keep low-lying farms from being flooded with seawater. As a result, the country has actually doubled its production of rice since the early 1970s. Similarly its frequent cyclones have prompted it to build cyclone shelters and develop early-warning systems for natural disasters. More recently various NGOs have set up floating schools, hospitals, and libraries that keep right on functioning through monsoon season.

"Let me tell you about Bangladeshis," says Zakir Kibria, 37, a political scientist who serves as a policy analyst at Uttaran, an NGO devoted to environmental justice and poverty eradication. "We may be poor and appear disorganized, but we are not victims. And when things get tough, people here do what they've always done—they find a way to adapt and survive. We're masters of 'climate resilience.'"

Muhammad Hayat Ali is a 40-year-old farmer, straight as bamboo, who lives east of Satkhira, about 30 miles upstream of the coast but still within range of tidal surges and the salinity of a slowly rising sea. "In previous times this land was juicy, all rice fields," Ali says, his arm sweeping the landscape. "But now the weather has changed—summer is longer and hotter than it used to be, and the rains aren't coming when they should. The rivers are saltier than before, and any water we get from the ground is too salty to grow rice. (Continued on page 80)



HIGH AND DRY When the river floods, the children of Labed Ali know what to do: Climb the bamboo macha in the front yard and hold on tight. Midstream islands and weirs are used in such calamities, which are on the increase.





KEEPING A COUNTRY AFLOAT An army of health workers trained by BRAC, a homegrown nongovernmental organization (NGO), have helped reduce both infant mortality and the birthrate (above). In the briny south, farmers have converted waterlogged rice fields into ponds for salt-tolerant shrimps and crabs.






Enterprising island inhabitants in the Gaibandha District use hyacinth plants to create floating gardens, where they will plant squash, okra, and other food crops (above). Docking six days a week, a solar-powered school boat (below) helps educate kids whose homes are periodically flooded.





A group of children, mostly boys, are sitting on the floor in a classroom. They are looking at papers or books. The room is dimly lit, with light coming from a window in the background. The children are wearing various colored shirts. The overall atmosphere is one of focused learning.

LONG-TERM LESSONS — flock year-round to a floating school. Traditionally homebound, girls especially benefit by having schools come to them. Studies show that educated girls (and boys, as well) have fewer children as adults.

“You should take a picture of this place and show it to people driving big cars in your country. Tell them it’s a preview of what South Florida will look like in 40 years.”

—Samir Ranjan Gayen, executive director of ■ local nonprofit

(Continued from page 73) So now I’m raising shrimps in these ponds and growing my vegetables on the embankments around them.” A decade ago such a pond would have been a novelty; now everyone, it seems, is raising shrimps or crabs and selling them to wholesalers for shipment to Dhaka or abroad.

Sometimes, though, adaptations backfire. Throughout southern Bangladesh, villages and fields are shielded from rivers by a network of dikes built by the government with help from Dutch engineers in the 1960s. During floods the rivers sometimes overflow the dikes and fill the fields like soup bowls. When the flood recedes, the water is trapped. The fields become waterlogged, unusable for years at a time.

Decades ago things got so bad in Satkhira—so many fields were waterlogged, so many farmers out of work—that members of the local community used picks and shovels to illegally cut a 20-yard gap in an embankment, draining a huge field that had been waterlogged for nearly three years. In doing so, they were emulating Bengali farmers of earlier times, who periodically broke their embankments and allowed river water to enter their fields, rising and falling with the tides, until the deposited sediment raised the level of the land. But this time the villagers were charged with breaking the law.

Then a funny thing happened. The field, which had been left open, acquired tons of sediment from the river and grew higher by five or six feet. The river channel deepened, and fishermen began to catch fish again. Finally a government study group came to survey the situation and wound up recommending that other fields be managed the same way. The villagers were vindicated, even hailed as heroes. And today

the field is covered with many acres of rice.

“Rivers are a lifeline for this region, and our ancestors knew that,” Kibria says as he walks an embankment. “Opening the fields connects everything. It raises the land level to make up for the rise in sea level. It preserves livelihoods and diversifies the kinds of crops that we can grow. It also keeps thousands of farmers and fishermen from giving up and moving to Dhaka.”

BUT EVERY ADAPTATION, no matter how clever, is only temporary. Even at its sharply reduced rate of growth, Bangladesh’s population will continue to expand—to perhaps more than 250 million by the turn of the next century—and some of its land will continue to dissolve. Where will all those people live, and what will they do for a living?

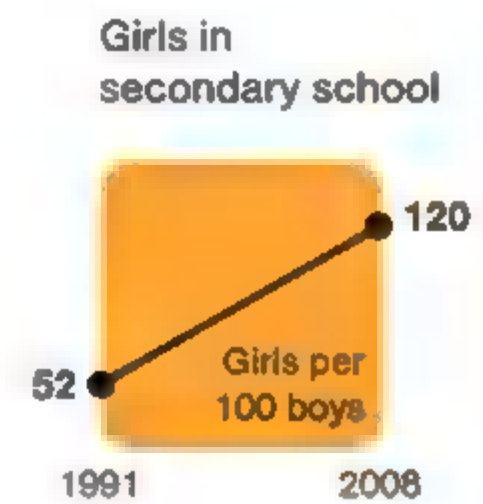
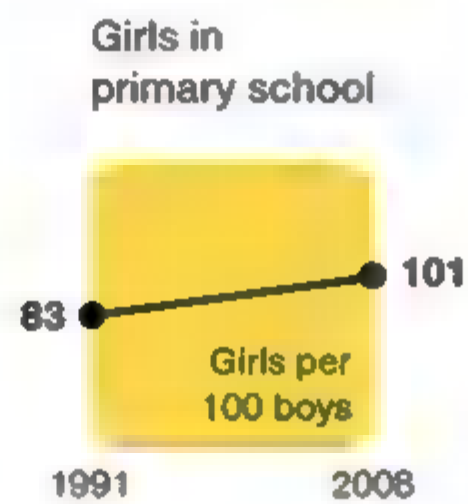
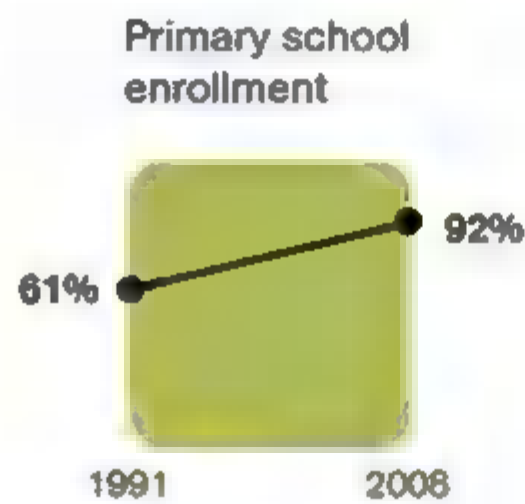
Many millions of Bangladeshis are already working abroad, whether in Western countries, in places such as Saudi Arabia and the United Arab Emirates, or in India, where millions fled during Bangladesh’s 1971 war of independence against Pakistan and never returned. Millions more have slipped across the frontier in the decades since, prompting social unrest and conflict. Today India seems determined to close and fortify its border, girding against some future mass migration of the type hypothesized in Washington. It’s building a 2,500-mile security fence along the border, and security guards have routinely shot people crossing illegally into India. Interviews with families of victims suggest that at least some of the dead were desperate teenagers seeking to help their families financially. They had been shot smuggling cattle from India, where the animals are protected by Hinduism, to Muslim Bangladesh, where they can fetch up to \$40 a head.

But if ten million climate refugees were ever

Girl Power

National efforts have raised primary school enrollment to 16.7 million students, with an emphasis on girls, who now outnumber boys in school.

NGM ART
SOURCE: GOVERNMENT OF BANGLADESH



to storm across the border into India, Maj. Gen. Muniruzzaman says, “those trigger-happy Indian border guards would soon run out of bullets.” He argues that developed countries—not just India—should be liberalizing immigration policies to head off such a chilling prospect. All around Bangladesh bright, ambitious, well-educated young people are plotting their exit strategies.

And that’s not such a bad idea, says Mohamed Mabud, a professor of public health at Dhaka’s North South University and president of the Organization for Population and Poverty Alleviation. Mabud believes that investing in educating Bangladeshis would not only help train professionals to work within the country but also make them desirable as immigrants to other countries—sort of a planned brain drain. Emigration could relieve some of the pressure that’s sure to slam down in the decades ahead. It’s also a way to bolster the country’s economy; remittances sent back by emigrants account for 11 percent of the country’s GDP. “If people can go abroad for employment, trade, or education and stay there for several years, many of them will stay,” he says. By the time climate change hits hardest, the population of Bangladesh could be reduced by 8 to 20 million people—if the government makes out-migration a more urgent priority.

For now, the government seems more interested in making climate adaptation a key part of its national development strategy. That translates, roughly, into using the country’s environmental woes as leverage in persuading the industrialized world to offer increased levels of aid. It’s a strategy that’s helped sustain Bangladesh throughout its short, traumatic history. Since independence, it has received tens of billions of dollars in

international aid commitments. And as part of the accord produced at the United Nations Climate Change Conference in Copenhagen in 2009, nations of the developed world committed to a goal of \$100 billion a year by 2020 to address the needs of poor countries on the front lines of climate change. Many in Bangladesh believe its share should be proportionate to its position as one of the countries most threatened.

“Climate change has become a kind of business, with lots of money flying around, lots of consultants,” says Abu Mostafa Kamal Uddin, former program manager for the government’s Climate Change Cell. “During the global financial meltdown, trillions of dollars were mobilized to save the world’s banks,” he says. “What’s wrong with helping the poor people of Bangladesh adapt to a situation we had nothing to do with creating?”

TWO YEARS AFTER THE CYCLONE, Munshiganj is still drying out. Nasir Uddin and his neighbors are struggling to wring the salt water out of their psyches, rebuild their lives, and avoid being eaten by the tigers that prowl the village at night, driven from the adjacent Sundarbans mangrove forest in search of easy prey. Attacks have risen as population and environmental pressures have increased. Dozens of residents around Munshiganj have perished or been wounded in recent years—two died the week I was there—and some of the attacks occurred in broad daylight.

“It’s bad here, but where else can we go?” Uddin says, surveying the four-foot-high mud platform where he’s planning to rebuild his house with an interest-free loan from an NGO. This time he’s using wood, which floats, instead of mud. The rice fields around his house are full



RESILIENT SPIRITS Children play on in Jaliakhali, a village devastated by Cyclone Aila in 2009. That storm sent residents racing for one of thousands of recently built cyclone shelters (above), many of which double as community centers.



of water, much of it brackish, and most local farmers have begun raising shrimps or crabs in the brine. Deep wells in the village have gone salty too, he says, forcing people to collect rain-water and apply to NGOs for a water ration, which is delivered by truck to a tank in the village and carried home in aluminum jugs, usually balanced on the heads of young women. “You should take a picture of this place and show it to people driving big cars in your country,” says Uddin’s neighbor Samir Ranjan Gayen, a short, bearded man who runs a local NGO. “Tell them it’s a preview of what South Florida will look like in 40 years.”

As the people of Munshiganj can attest, there’s no arguing with the sea, which is coming for this land sooner or later. And yet it’s hard to imagine millions of Bangladeshis packing up and fleeing en masse to India, no matter how bad things become. They’ll likely adapt until the bitter end, and then, when things become impossible, adapt a little more. It’s a matter of national mentality—a fierce instinct for survival combined with a willingness to put up with conditions the rest of us might not.

Abdullah Abu Sayeed, a literacy advocate, explains it this way: “One day I was driving on one of the busiest streets in Dhaka—thousands of vehicles, all of them in a hurry—and I almost ran over a little boy, no more than five or six years old, who was fast asleep on the road divider in the middle of traffic. Cars were whizzing by, passing just inches from his head. But he was at peace, taking a nap in some of the craziest traffic in the world. That’s Bangladesh. We are used to precarious circumstances, and our expectations are very, very low. It’s why we can adapt to just about anything.” □



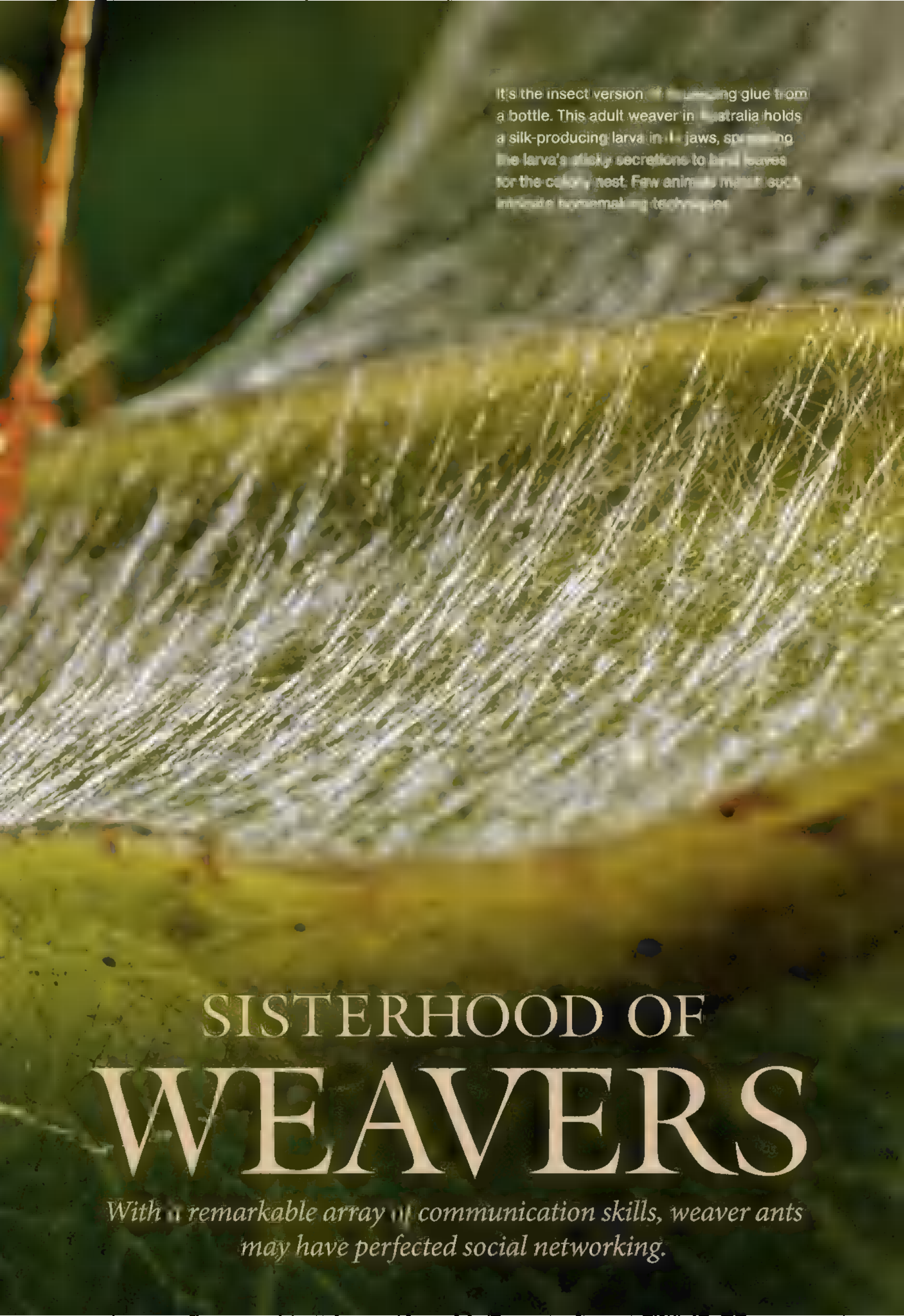
SEVEN BILLION IN JULY

What it will take to feed nine billion people in 2045.

The Pulitzer Center on Crisis Reporting and PBS NewsHour join us in reporting on population issues throughout the year.

The magazine thanks the David and Lucile Packard Foundation, the Wallace Global Fund, and National Geographic Society members for their generous support.





It's the insect version of squeezing glue from a bottle. This adult weaver in Australia holds a silk-producing larva in its jaws, spreading the larva's sticky secretions to bind leaves for the colony nest. Few animals master such intricate burrowmaking techniques.

SISTERHOOD OF WEAVERS

With a remarkable array of communication skills, weaver ants may have perfected social networking.



As weaver ants build a nest in Malaysia, they must pull one leaf toward another. A long body—about a third of an inch—is a boon, as each ant grabs on to adjacent leaf edges with feet and jaws. If one body isn't sufficient, the insects interlock to form chains.



By Douglas H. Chadwick

Photographs by Mark W. Moffett

If aliens ever do land on Earth, don't get all huffy if their greeting turns out to be: "Take me to your ant."

That ant might be a queen mother, weighing about the same as a few grains of salt. But she, along with other queens and their worldwide empires, would match the weight of the seven billion people seething across the planet these days. Plus, the queens and their offspring have been living in large, highly organized, cooperative societies—practicing activities from strategic army warfare to agriculture and livestock herding—for at least 50 million years. We've been at it for, what, 10,000, tops?

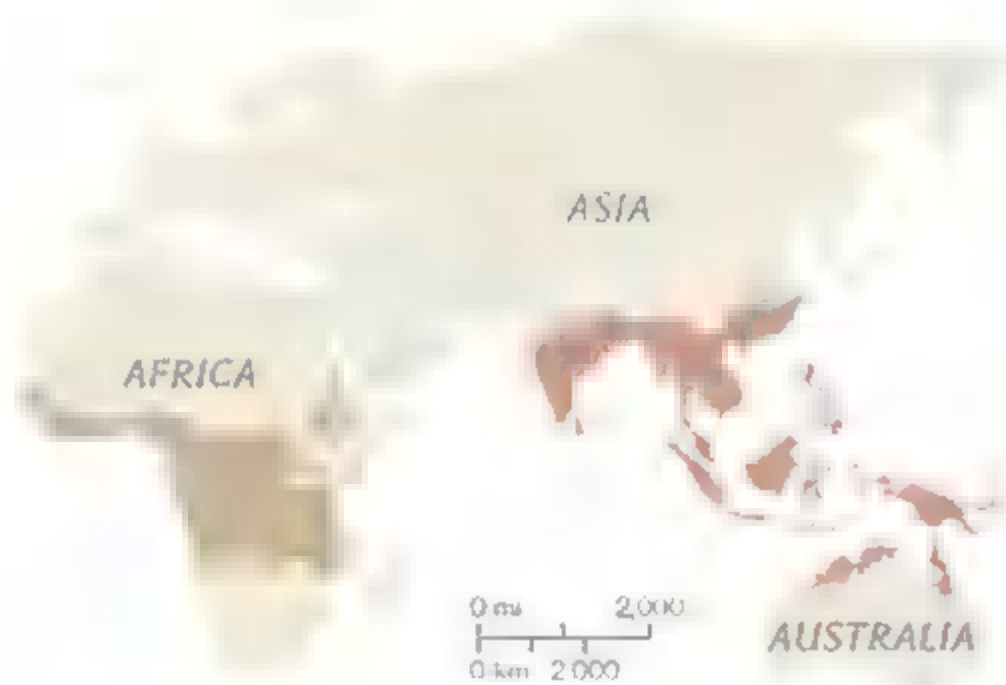
I'd nominate entomologist and photographer Mark Moffett as the aliens' escort. During years of jungle quests he has discovered new ant species and astonishing ant behaviors. Even over breakfast here in the rain forest of Queensland, Australia, he's pondering what sort of organism an ant colony amounts to, since it is this social group as a whole, not the individual, that really competes in the struggle for survival and evolves over time. Consider the colony as a unified body in which individual members are like cells, with castes of them performing separate duties like specialized organs.

JUST ABOVE OUR HEADS, in the rain forest canopy, streams the almost perfect society. In other tropical and subtropical woodlands, scores of different ant species may share a single tree. But

Douglas H. Chadwick's new book is *The Wolverine Way*; Mark W. Moffett's is *Adventures Among Ants*. Both were published in 2010.



Range of weaver ant (*Oecophylla*)
■ *O. longinoda*
■ *O. smaragdina*



Weaver nests can be spacious: This one in Cambodia is eight inches wide; others reach a foot or two. A colony can distribute the weight of a half million workers, equal to that of a large house cat, by maintaining upwards of a hundred nests spread over multiple trees.



there's little room for coexistence where the ants known as *Oecophylla* make their home—one species here in Australia and in southern Asia, the other in parts of Africa. Long-legged and lithe, they so aggressively dominate huge territories in the forest canopies that locals simply call them the tree ants.

Or weaver ants, because they make their soccer-ball-size nests among the branches by sewing leaves together. Each weaver ant colony

inhabits from half a dozen to more than a hundred nests at any given time, forming a metropolis of boroughs and suburbs connected by busy commuter routes. A hierarchy of workers and soldiers maintains and defends this territory, which spreads from treetops to the forest floor, staying in sync through constant communication. They touch each other with mouths, forelegs, or antennae. They lay down scents with different glands to send different

Save the queen! If disturbed by an intruder, minor workers—the caste of ants that tends to her majesty—envelop the matriarch (below, in Australia) to protect her from harm. The queen is the grower of the superorganism, producing tens of millions of eggs over her life span of several years.



messages. They release more pheromones into the air to broadcast signals quickly and widely. They even display symbolic behavior: To warn of an approaching enemy, for instance, they jerk their bodies in a kind of ritualized fight.

Scientists have likened weaver ant communication to a type of language with primitive syntax. Urban planners examine the organization of ant societies. Mathematicians draw upon analyses of ant behavior to devise parallel computing formulas (where multiple problems are solved simultaneously). Ants serve as models in all kinds of studies aimed at figuring out how big, complex jobs get done with small parts and a minimum of instructions.

Here is how a weaver ant nest-construction project gets under way.

A single worker stands on a leaf and reaches to grasp the edge of another leaf nearby. If the span is too great, a second worker climbs over the first, and the bottom ant grasps the newcomer by its wire-thin waist and holds it out closer to the goal. Still not enough? A third ant clambers over the first two and is lifted out farther yet. Ant by ant, a living chain grows into thin air like the arm of a construction crane. Once the distant leaf is grabbed, the squad pulls in unison, often with nest mates that have formed parallel chains and reinforcing cross-links, to draw the

leaves' edges together. Workers begin to array themselves like live staples along the seam between the leaves, legs holding on to one edge, jaws gripping the other. And then? They wait.

As evening comes on and the humidity rises, more workers arrive from nearby nests. They're carrying larvae that are about to enter the pupal stage and metamorphose into adults.

Larvae of other ant species spin individual protective cocoons of silk. *Oecophylla* larvae donate their silk to the colony. Straddling the leaf seam, an adult uses its antennae to tap the head of the larva held in its jaws, telling it to extrude silk from its salivary glands. A worker's operating manual would read: Swing head to one side. Tappity-tap larva. Dab glob of its silk onto leaf. Swing head opposite way, drawing thread across to other leaf. Keep tappity-tapping larva. Dab next glob there. Step forward. Repeat procedure. When finished, move on to other tasks.

If you're close enough to witness this use of juveniles as sewing tools, some workers are probably going to be biting you, having caught your motion with their keen eyes, sensed the odors in your breath, or felt movement when you brushed a branch. When you're really close, an agitated throng coats the nearest plant parts like bristling fur, each ant lifting its body high on four legs, raising its gaster—the largest and

hindmost segment of its body—up (sometimes vibrating it), a posture that signals excitement. The two front legs flail forward; they can hardly wait to grab you. The sharp-tipped, curving jaws are cocked open, poised to pincer, puncture, and inject some glandular concoction that adds extra hurt; it may make you woozy as the number of bites adds up.

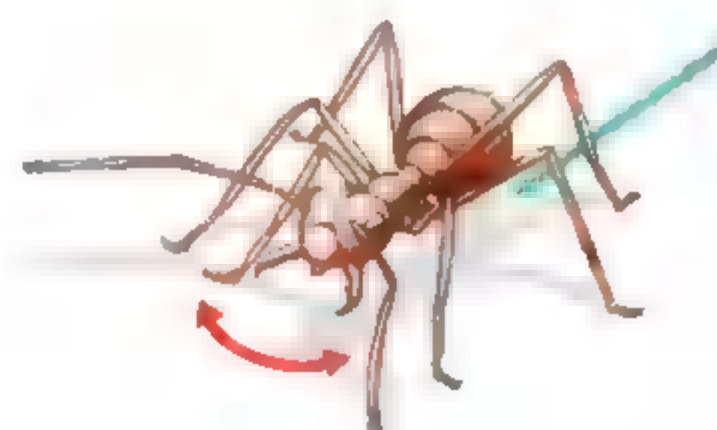
Meanwhile the troops are spraying formic acid, which burns the nostrils like a whiff of ammonia. They're also releasing alarm pheromones, from that upraised rear end as well as those formidable jaws, while other workers race off to contact nest mates directly, establishing scent trails along the way to guide them toward the threat. Give the recruiters a few minutes, and thousands may be streaming in your direction. Don't linger. The population of some colonies exceeds half a million.

IN ONE OF THE COMPLETED NESTS a queen, many times the size of typical workers (called majors and minors), is pumping out eggs. When the larvae hatch from the eggs, some of the workers feed and clean them and transport a portion of them to nurseries in other nests. Every so often a large batch of reproductive females and males is produced. They sprout wings and fly off to mate, and the fertilized females may start new colonies. The rest of the time, the queen's offspring all become nonbreeding females—a fierce sisterhood of near clones that patrol their colony's territory, search out and collect food, and grapple with any invader, no matter how big, no matter how deadly, in service to her majesty and the survival of the colony as a whole.

A queen may live years, the average worker maybe months, Moffett says, adding: "Any major that actually dies of old age hasn't been doing its job for the colony." Two of the scientists he worked with when he was a graduate student at Harvard University, leading ant experts Bert Hölldobler and Edward O. Wilson, found that the oldest workers end up in barrack nests near the front lines of a colony's territory; they're the most likely to encounter enemies and fall in battle. "A principal difference between human

ARTICULATE ANTS

Weaver ants send explicit communications to one another by combining a complex repertoire of physical movements with chemical signals from their rectal, sternal, and mandibular glands.



We have food

- CHEMICAL SIGNAL
Ant lays odor trail to food site using rectal gland.
- MOVEMENT
When meeting another worker, ant waves head and mimes offering food.



There's an intruder nearby

- Ant emits alarm pheromones from mandibular gland.
- Ant drags abdomen and leaves a short, looping trail from sternal gland.



Join a new nest

- Ant uses rectal gland to lay odor trail to new nest site.
- Ant jerks its body, tugs on nest mate's mandibles.

ART: MARIEL FURLONG, NGM STAFF
SOURCES: MARK W. MOFFETT; *THE SUPERORGANISM*, BY BERT HÖLLDOBLER AND EDWARD O. WILSON



With speed and sheer numbers, weaver ants can overwhelm and pin scorpions and other large prey. These hunters in Cambodia will carry the scorpion to the nest and tear off bits to feed the larvae, which need all the protein they can get.



A *Cosmophasis* jumping spider (below, at left) has infiltrated a weaver nest in Australia using chemical mimicry. By eating weaver ant larvae, the spider can take on and emit the scent of a colony and then feed unnoticed among its prey. But the spider cannot use that colony's scent to fool a different colony.



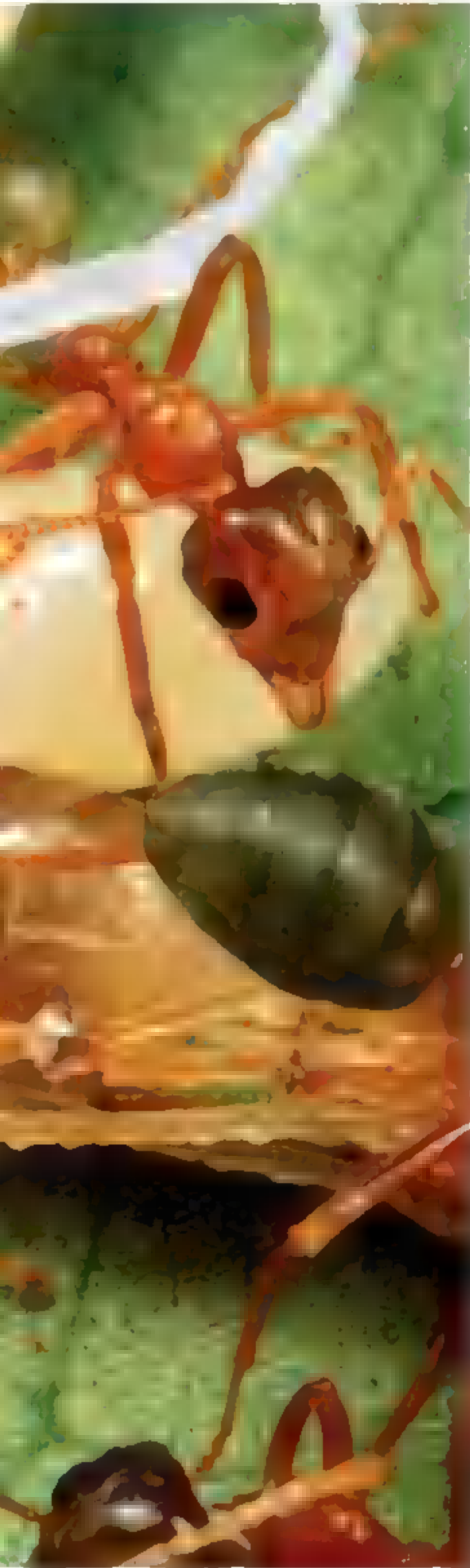
beings and ants,” those researchers have written, “is that whereas we send our young men to war, they send their old ladies.”

SOMEWHERE OFF IN THE BLACK rain forest night, Moffett is singing nonsense jingles interrupted by little squeaks and *hmmms*. It means he’s trying to keep focused while being bitten. When I find him, he’s peeling back silk-hemmed leaves to peer at the inner workings of a nest,

and defenders are swarming his arms, sprinting toward his bare neck.

Mapping out colonies in an orchard at the forest’s edge the following morning, we find one that encompasses 17 trees. “Compared with a continuous ground surface, treetops aren’t able to support many heavy-bodied animals,” Moffett says. “Plenty of territory to roam up there, but it’s mainly leaves. So if you’re a predator, the best way to control a large territory in the

A *Myrmarachne* jumping spider stalks a weaver ant (below). The spider so resembles the ant—which tastes foul to some animals—that the spider’s usual predators often pass it by. A theridiid spider snags an ant (bottom, green abdomen) with a silk line, then descends on a second line to claim its prize.



canopy is to be small yourself but abundant enough to reach all those little surfaces. Think of a colony as a single critter spreading itself through the trees as a thin film.”

As predators, weaver ants hunt practically every kind of invertebrate big enough for a meal—and so effectively that the ants’ territories become patches where many creatures can exist only at low populations, if at all. Chinese farmers noticed this 1,700 years ago and

placed nests in orchards to safeguard fruit, making *Oecophylla* the oldest known form of biocontrol. Lately ecologists have been promoting it in Africa as a safe, effective, and inexpensive alternative to pesticide sprays. The poorest farmer can run strings from a weaver ant nest to fruit trees, and legions of female warriors will tirelessly eliminate fruit flies, caterpillars, and other potential pests for free.

As soon as a major latches on to prey, another



They can tear apart a well-armored African driver ant at least twice their size (below), and they rear up aggressively at a looming photographer (left). Whatever the threat, weaver ants fight together: The first defenders stand tall and emit pheromones that draw their sisters to battle.



maneuvers to grab and pull a leg or antenna. Within moments, half a dozen or more majors will have the victim—be it soft-winged moth, scout from a foreign ant colony, or burly scorpion—spread-eagled, stretched beyond its limits, and about to be ripped apart. A couple more sisters gnaw at weak points to hasten the job. Holding the pieces aloft, workers join the river of ants flowing back toward a nest laden with prizes from other hunts. The heaviest chunks are carried by groups that somehow keep coordinated, even as some team members leave and new workers join in.

All the while, different platoons are out tending scale insects and other homopterans (sucking insects that feed on plant juices). The shepherds physically carry this livestock to prime pastures, guard the herds vigilantly from enemies, and gather special droplets of sugar-rich syrup, known as honeydew, that the bugs excrete. Like every bounty, it is then carried off to be shared with nest mates—added to the communal gut.

Even the stodgiest scientists are growing more comfortable with the notion of the ant colony as a superorganism. Moffett's musings lean further out. He keeps trying to explain to me how weaver ants operate in an Einsteinian universe where space bends and warps. Mentally

shrink yourself to ant size and set out walking on a leaf. It's a two-dimensional plane, except that it curves and twists and after a while suddenly falls off into thin air. No matter, you just climb over the edge and keep walking on the underside, then wend your way down a stem to another curling green surface.

"Weaver ants weigh so little, they're scarcely affected by gravity," Moffett says. "The rocking of branches in the wind is a stronger force to them, so they often don't know which way is down. But if an ant wants to go from one tree to the next, there's a huge gap relative to its size. It might have to travel all the way to the ground, back up again, and then out on another branch. What *Oecophylla* often does, though, is get a bunch of buddies together to form an air bridge and cross directly to the other side."

Moffett may be the only person who perceives ants in *Star Wars* hyperspace, short-circuiting the usual rules of time and gravity. Still, the rest of us can look almost anywhere and see an ant crawling around and be reminded that nature has invented many ways for animals to be powerful and multitudes of ways for them to be smart. □

■ **Society Grant** Mark Moffett's research on weaver ants was funded in part by your Society membership.



A new generation of superclimbers is pushing the limits in

Yosemite. Daring. Defiant. Free.

By Mark Jenkins
Photographs by Jimmy Chin

With no rope to save him,
Dean Potter scales a route on
Glacier Point called Heaven.

PHOTO: MIKEY SCHAEFER





Simply holding on with a hand chalked for better grip, Cedar Wright ignores burning muscles to pull himself across the roof of Gravity Ceiling, a route on Higher Cathedral Rock. "I'm giving it 199 percent," he says. "But I still thought I was calm and cool."

On a bright

Saturday morning in September a young man is clinging to the face of Half Dome, a sheer 2,130-foot wall of granite in the heart of Yosemite Valley. He's alone, so high off the ground that perhaps only the eagles take notice.

Hanging on by his fingertips to an edge of rock as thin as a dime, shoes smeared on mere ripples in the rock, Eminem blasting on his iPod, Alex Honnold is attempting something no one has ever tried before: to climb the Regular Northwest Face route on Half Dome without a rope. He's less than a hundred feet from the summit when something potentially disastrous occurs—he loses the smallest measure of confidence.

For two hours and 45 minutes Honnold has been in the zone, flawlessly performing hundreds of precise athletic moves one after another, and not once has he hesitated. In the sport of free soloing, which means climbing with only a powdery chalk bag and rock shoes—no rope, no gear, nothing to keep you stuck to the stone but your own belief and ability—doubt is dangerous. If Honnold's fingertips can't hold, or if he merely believes his fingertips can't hold, he will fall to his death. Now, the spell suddenly broken by mental fatigue and the glass-slick slab in front of him, he's paralyzed.

"My foot will never stay on that," Honnold says to himself, staring at a greasy bump on the rock face. "Oh God, I'm screwed."

He hadn't felt that way two days before, when he'd raced up the same route with a rope. That climb had gone so smoothly he was certain he could free solo it, despite the route's legendary difficulty. When Half Dome was first climbed, in 1957, it had taken Californian Royal Robbins and his teammates five days. To get to the top, 4,840 feet above the valley floor, they'd pounded a hundred or so pitons, thin wedges of steel, into the rock, from which they'd hung ropes to climb—a style called aid climbing. A generation later, in 1976, Coloradans Art Higbee and Jim

Erickson climbed Half Dome almost completely free—relying only on hands and feet wedged into the cracks, using ropes only to catch a fall—in 34 hours. For Honnold to free solo Half Dome would be to raise the bar almost beyond belief.

Now, clinging to the granite, Honnold vacillates, delicately chalking one hand, then the other, vigilantly adjusting his feet on invisibly small footholds. Then abruptly he's in motion again, stepping up, smearing his shoe on the slick knob. It sticks. He moves his hand to another hold, crimping his fingers on the tiny edge. Within minutes he's at the top.

"I rallied because there was nothing else I could do," Honnold tells me later, releasing a boyish laugh. "I stepped up and trusted that terrible foothold and was freed of the little prison where I'd stood silently for five minutes."

Word of his two-hour-and-50-minute free solo of Half Dome flashes around the world. Climbers are stunned, and bloggers buzz. On this warm fall day in 2008 the nerdy, plays-Scrabble-with-his-mom 23-year-old from the suburbs of Sacramento has just set a new record in climbing's biggest of big leagues.

THIS IS THE MAGIC of Yosemite: It forges heroes. No matter where they come from, from the Alps to the Andes, all self-respecting rock climbers yearn to make a pilgrimage to "the valley" to measure themselves against its giants: El Capitan, a shimmering prow of stone so immense it makes the hundred-foot ponderosa pines at its base look miniature; Cathedral Rocks, a dark fortress forever in the shade; and Half Dome, a granite apple cleaved in half, its soaring northwest face an invitation to the boldest climbers

Sweltering sun prompts Tommy Caldwell (at left) and Kevin Jorgeson to take a break from their quest to free climb a new route on El Capitan.



in the world. To climb here is a rite of passage.

I made my first journey to the valley in the 1970s, a hungry teenager hitchhiking from Wyoming with a \$20 bill and a climbing rope. Having grown up on the High Plains and tested myself in the Rockies, I wanted to believe I was ready. A vacationing family from Iowa in a station wagon, with three kids and a golden retriever, dropped me off in a meadow beneath the shadow of El Capitan, and I must have stood there with my head tilted back, stunned, for 15 minutes.

I stayed in Camp 4, Yosemite's notoriously rowdy campground for climbers. Back then, Camp 4 was all bell-bottoms and beads, torn tents and worn sleeping bags. Climbers were long-haired, hard-partying rebels, addicted to independence and the thrill of scaling big

rocks and thus the bane of park rangers, who were known as "the tools."

The feeling was mutual. One midnight, after barely getting up a big wall, my friends and I stumbled back into camp only to discover that the rangers had confiscated our tent because we'd overstayed our permit. We slept in the dirt that night and from then on "stealth bivvied," rolling out our sleeping bags in the forest or among the boulders, sleeping under the stars, and returning to the walls before daybreak (still a common practice). We collected aluminum cans for cash and lived on peanut butter and cheap beer,

Mark Jenkins is a contributing writer. Jimmy Chin, a 2004 National Geographic emerging explorer, has photographed climbers all over the world.





Despite the...
the... of the...
No... Face...
with... &...
...
who...
at...
...
...
...
...

CLIMBING STYLES

Climbing routes

A selection of the more than 100 established routes is shown here.

- Featured in article
- Other

Aid (specialized)

Nylon stirrup ladders attached to placed hardware support the climber's weight.

Most ←-----



Free (most popular)

Harnessed to a rope to halt falls, climbers use hands and feet to move up the rock.

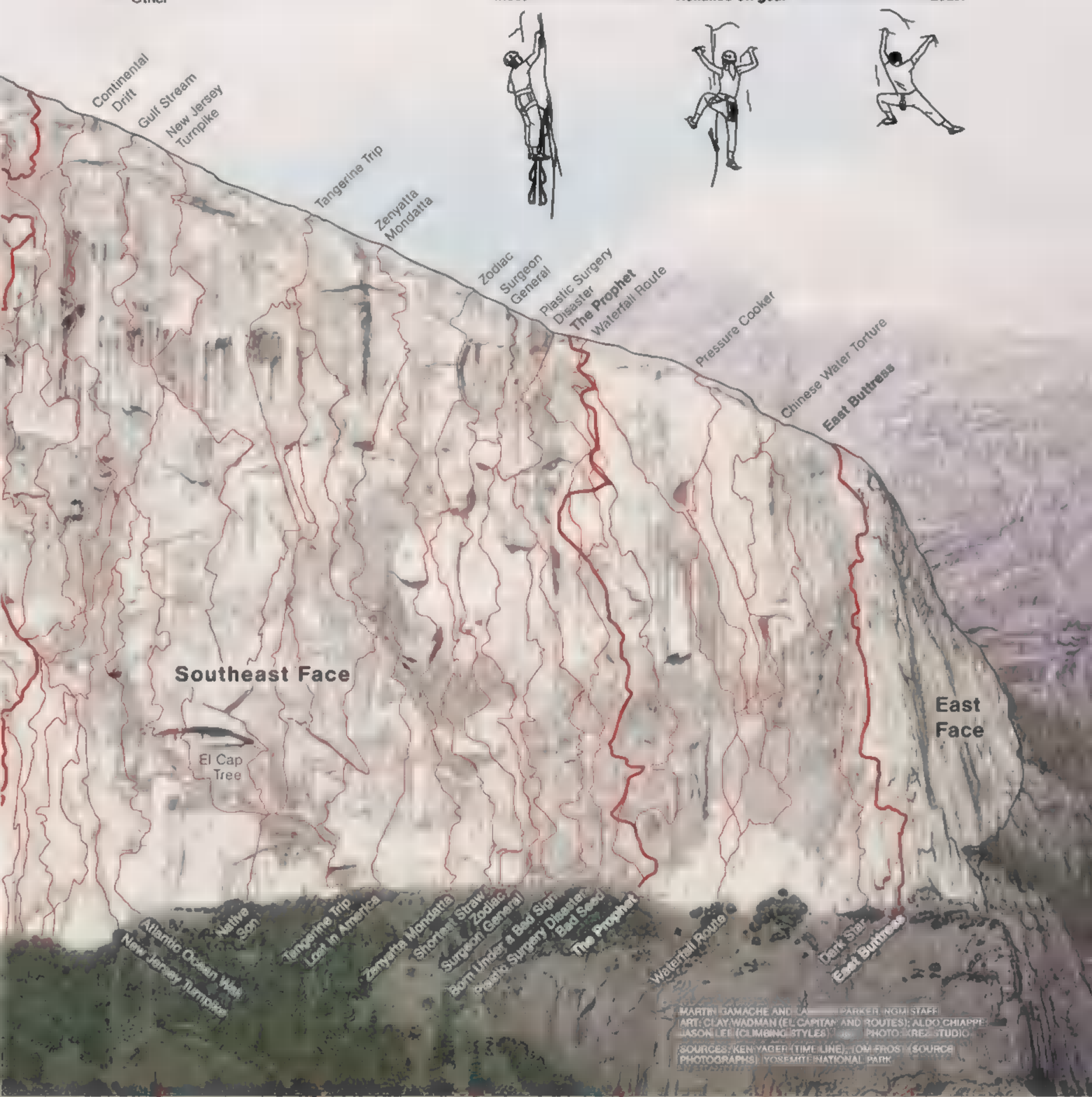
-----Reliance on gear-----



Free solo (rare)

Climbing without ropes; falls are usually fatal. No major El Cap route has been free soloed.

-----Least



MARTIN DAMACHE AND LA PARKER, INGM STAFF
 ART: CLAY WADMAN (EL CAPITAN AND ROUTES); ALDO CHIAPPE
 JASON LEE (CLIMBING STYLES); PHOTO: KRE STUDIO
 SOURCES: KEN YAGER (TIME LINE); TOM FROST (SOURCE
 PHOTOGRAPHS); YOSEMITE NATIONAL PARK

- 1990** First climbing of two El Cap routes in one day: Dave Schultz and Peter Croft do the Nose and Salathé Wall.
- 1993** Lynn Hill becomes first to free climb the Nose. A year later she free climbs the route in 23 hours.
- 1993** Three El Cap routes are climbed in one day by Hans Florine and Steve Schneider.
- 2005** The Nose free climbed in 12 hours by Tommy Caldwell and Beth Rodden.
- 2010** The newest route, the Prophet, is free climbed by Leo Houlding and Jason Pickles, who spent nine years creating.
- 2010** Dean Potter and Sean Leary climb the Nose in two hours, 36 minutes, 45 seconds.

and we couldn't have been happier.

But I was a Camp 4 tourist, soon to return to Wyoming. The lore of Camp 4 came from those who lived there all summer, every summer, like hobos, constantly pushing the limits of their abilities and the park's tolerance. To this day, Camp 4 fables are staples of campfires round the world. Once, a drug smugglers' plane stuffed with bales of weed and wads of cash crashed in the high country. The ragged, sandaled lads of Camp 4 marched back and forth through the snow, absconding with the loot. For a time, T-bone steaks replaced tinned sardines. One climber rolled out of Yosemite in a broken-down DeSoto and returned ten days later in a red convertible Lincoln Continental. A few others lit out for the Alps with dreams of grandeur but didn't make it any farther than a bordello in Bordeaux, returning fat and flat broke the next year.

That was then. Things have changed. Visiting a Yosemite climbing camp today, you're just as likely to meet a divorce attorney from Delaware as a wild-haired dirtbag. Walking through Camp 4 one morning, I hear a dozen languages—Czech, Chinese, Thai, Italian—and meet climbers from all walks of life. A young German engineer, grinning ear to ear, has just completed a five-day ascent of El Cap. A barefoot young woman from Denmark, with nose ring, dreads, a tattoo, walks a slackline—a tightrope strung three feet off the ground between trees. A mom and dad from Washington State teach their two kids how to climb. Rock climbing is no longer a fringe sport. It's mainstream. And unlike the early years, there are nearly as many women as men on the rock—a welcome change reflected in the accomplishments of one person: Lynn Hill.

"I started hanging out in Camp 4 when I was 15," says Hill, now 50. "I was practically the only girl there." A former high school gymnast, she was a fearless climber, bringing a fluid gracefulness to the sport. By the time she was 17, Hill had scaled Half Dome.

"Lynnie was a genetic freak," says climber John Long. "She was the strongest, most stubbornly

Visiting Yosemite today, you're just as likely to meet a divorce attorney from Delaware as a wild-haired dirtbag.

dogged, most gifted climber I'd ever met. Her weight-to-strength ratio was ridiculous."

After perfecting her craft in Yosemite, Hill moved on to other venues, winning dozens of competitions in Europe. Then in 1994, at 33, she returned to Yosemite with an audacious plan: to free climb the Nose on El Capitan in a day. "All the naysayers said it was impossible," Hill says. "Except John." The Nose, a 2,916-foot line on El Cap, may be the most famous rock-climbing

route in the world. To scale it, you must painfully twist your hands and feet, fingers and toes into vertical cracks. In 1975 Long, with Jim Bridwell and Billy Westbay, completed the first one-day ascent of the Nose, although his team relied on aid climbing to get past the Great Roof, a harrowing overhang two-thirds of the way up.

Determined to free the Great Roof, Hill clung to the smallest fingerholds, hanging upside down, feet skittering off the slick wall. Using what she calls "delicate tai chi dance steps," she managed to surmount the roof with what were essentially fingertip side pulls. She reached the summit of El Cap in 23 hours—a feat considered by many today to be the ultimate climbing accomplishment of the late 20th century.

REGARDLESS OF ABILITY, every climber comes to Yosemite with a dream: a route he or she is aching to do. When I first arrived, I had my heart set on the Steck-Salathé on Sentinel Rock—a route that requires plugging your whole body into a wide crack. Alas, in the event, the wall was too big and my partner and I too green. We ignominiously bailed only halfway up.

Now, 30 years later, Dean Potter offers to climb it with me. One of the last long-haired rebels still living in the valley, Potter, 38, is intense, built like Tarzan, and known for his ropeless ascents and bold BASE jumps, leaping off cliffs with a parachute. But Potter has rules for me. I'm not allowed to bring any food or water, no backpack or raincoat, not even a helmet. "It's the only way to move fast," he says.



Jorgeson (at left) and Caldwell live in a "portaledge" 1,500 feet above the valley for up to two weeks when working on a route. The best amenities in their studio in the sky? A French press for coffee and iPhones (charged with a solar panel). On the ground, climbers commune in legendary Camp 4, including the section where search-and-rescue workers live (below).







"It feels like I'm hovering in space," says Dean Potter, perched on a high-line above Yosemite Falls. Gusting winds and blinding mist make it tough to balance on the inch-thick rope 2,600 feet above the valley, but a tether attached to his waist protects him from disaster.



PHOTOGRAPH BY [unreadable] FOR
[unreadable] FROM [unreadable] AND [unreadable]
[unreadable] FOR [unreadable] [unreadable]
[unreadable] [unreadable] [unreadable] [unreadable]
[unreadable] [unreadable] [unreadable] [unreadable]
[unreadable] [unreadable] [unreadable] [unreadable]
[unreadable] [unreadable] [unreadable] [unreadable]
[unreadable] [unreadable] [unreadable] [unreadable]

Speed has become the creed of the new überclimbers. “We’ll make a leisurely day of it,” Potter promises. To save weight, he goes barefoot during the nasty, bushwhacking approach. At the base, after stretching on our painfully tight rock shoes, we rope up and begin ascending the 1,500-foot route like monkeys, hand jamming up cracks, squeezing through chimneys, climbing face holds as if they were a ladder. We top out in less than four hours. I feel like we’ve flown up the route, until Potter tells me that he often free solos it in an hour.

This is the trend. Most routes are now familiar, and equipment and skills are vastly improved. So speed rather than exploration has become a key measure of a climber’s craft. In 1950, when Allen Steck and John Salathé first climbed the route that bears their name, they took five days. The first ascent of the Nose was a 47-day siege over a year and a half, from 1957 to ’58, by fun-loving iconoclast Warren Harding. Today slow parties take three to five days, spending nights on “portaedges,” tiny tents hanging from the wall; fast climbers do it in a day. The record for the Nose is an unimaginable two hours, 36 minutes, and 45 seconds, set last November by Potter and Sean “Stanley” Leary.

Climbing in the ’70s was about adventure as much as athletics. Today it’s evolved into vertical gymnastics. Elite climbers are disciplined athletes who train constantly, repeating movements to perfection. As driven as Lance Armstrong or Michael Phelps, they’re obsessed with their weight, because completing, or “sending,” a route is all about defying gravity. Consider the 30 or so climbers who show up at a party at Potter’s cabin. In the old days such a gathering would be a rager, roaring till dawn. No longer. Nobody smokes, hardly anybody drinks. Potter serves a sensible vegetable-and-rice dish, four climbers bring homemade apple pies, and one and all are in bed before midnight, because everybody has a “project” they’re working on the next day.

Alex Honnold and Ueli Steck are among those who attend. Steck, a leading Swiss climber,

Potter has rules for me. I’m not allowed to bring any food or water, no backpack or raincoat, not even a helmet.

epitomizes the new breed, following a strict exercise and diet regime. When training, the 34-year-old runs an astonishing 10,000 vertical feet a day. Having set speed records on all three of the great north faces in the Alps—the Eiger (2:48), the Matterhorn (1:56), and the Grandes Jorasses (2:21)—Steck has come to Yosemite to sharpen his climbing in granite cracks. Last year he and Honnold dashed up El Cap in three hours and 50 minutes. His dream is to take speed climbing to the Himalaya.

“No technical route on an 8,000-meter peak has been done in Alpine style,” he says, meaning fast and light. “That is my mission.”

Unlike European pros such as Steck, who enjoy generous corporate sponsorship, most American climbers barely get by financially. Many earn just enough cash to crash in their vans and eat beans and rice. Indeed, because of the seven-day restriction at Camp 4, many live full-time in vehicles at Yosemite. Kate Rutherford, 30, and Madeleine Sorkin, 29, who together made the first female free ascent of Half Dome, both live in their vans. Honnold lives in his van. Colorado climber Tommy Caldwell, 32, one of the best granite free climbers in America, lives in his van when he’s in Yosemite—despite having been a professional climber since the age of 16.

Yet they still come back. Since 2007 Caldwell has been working on free climbing a new route near Mescalito on El Cap that may be the world’s hardest big-wall free climb. “I’ve been climbing my whole life,” he says. “First roped up when I was three years old.” Caldwell’s father was a mountain guide; Tommy remembers lying in an El Cap meadow as a kid watching his dad climb, just as other kids watched their dads play catch.

“There’s something magnetic about Yosemite,” he says. “All the history. I freak out the moment I get here and look up at the walls.”

ABOUT FOUR MILLION people visit Yosemite every year, only a few thousand of whom are climbers. But the climbers still represent the beating heart of the valley. “I came here as a sophomore

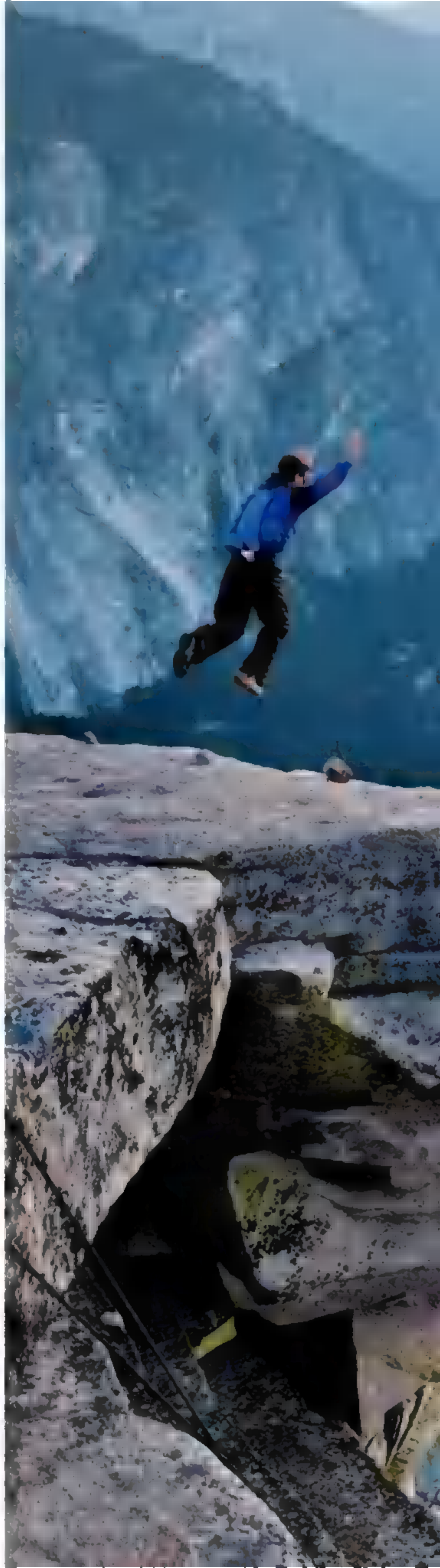
in high school and never went back home," says Ron Kauk, 53. "This place, Yosemite, was my education. If you let it, it can imprint a value system on you." To that end, Kauk started the Sacred Rok program to bring troubled kids to Yosemite to teach them how to think and feel for themselves. "Passing a bottle of water to your partner a thousand feet off the ground," he says, "you make sure he's got a good grip on it."

Kauk established some of the hardest routes in the valley, almost always climbing with a rope—which may be why he didn't become one of the 83 climbers who've died here since 1955. By contrast, free soloing leaves no room for error. As Dean Potter bluntly puts it, "You mess up, you die." Climbing unroped eventually caught up with two of Yosemite's best soloists: Derek Hersey, a Brit who fell from the Steck-Salathé in 1993, and Californian John Bachar, a former climbing partner of Kauk's who died in 2009 while free soloing near Mammoth Lakes.

Nevertheless, Honnold insists that Yosemite climbers still haven't reached the limits for free soloing. "Theoretically, you should be able to climb harder without a rope because you have less weight, fewer movements," he says. Looking past Half Dome, many routes here have never been free soloed. It's just a matter of time until someone—maybe Honnold—gives them a try.

My last night in the valley I wander through Camp 4 at dusk. The scent of pine sap and campfires floats in the air, and a couple of stars have just come out. There's laughter, and someone is playing a guitar. At one campsite two young men are methodically laying out gear—ropes and carabiners and milk jugs of water—talking gravely about what they hope will happen on their wall the next morning. At another picnic table three women with bloody knuckles, all in pigtails and wearing headlamps, are crying, hugging each other, having just come off a three-day ascent.

Like those who made the pilgrimage before them and those who will follow, they've come to Yosemite to test themselves against the rock. They know that these walls are more than mountains: They're giant mirrors that unsparingly reflect what lies inside each climber. □



Leaving from Half Dome
is about 100 ft in 10 seconds
the rest of BASE jumping
is waiting in limbo.
Anyway, Clissold says
it's faster (and more fun)
to parachute into the
valley than to hike all
the way down the back
of the mountain.





An inverted image of New York City's Central Park in fall, plasmas on the floor and ceiling in a photograph using the technique of camera obscura. Darken a room, make a small opening in the wall, and let the outside come in.

ROOMS WITH A VIEW

Photographer
Abelardo Morell's
camera obscura turns
darkened rooms into
magical landscapes.

PHOTOGRAPHS BY ABELARDO MORELL

Something strange and wonderful happens when light enters a dark space through a tiny opening. Aristotle described the phenomenon back in the fourth century B.C. Leonardo in Renaissance Italy sketched the process. In Coney Island and other 19th-century seaside resorts, tourists lined up to see the magical results. Shift to a Boston classroom, the year 1988. Cuban-born Abelardo Morell, teaching an introductory photography course at an art college, was curious to step back in time. On a sunny day, he covered the classroom windows with black plastic, making the space as dark as a cave, cut a dime-size hole in the material,

and told his students to watch. Almost instantly the back wall came alive like a movie screen, its surface covered with a fuzzy image of people and cars moving along Huntington Avenue outside. Then the double take: The image was upside down, sky on floor, ground on ceiling, the laws of gravity seemingly gone haywire.

Morell had turned his classroom into a camera obscura, a dark chamber, the Latin name for perhaps the earliest known imaging device and the ancestor of the photographic camera.

Explaining the optical principle behind the device is probably the most complicated thing about it. A camera obscura receives images just like the human eye—through a small opening and upside down. Light from outside enters the hole at an angle, the rays reflected from tops of objects, like trees, coursing downward, and those from the lower plane, say flowers, traveling upward,

the rays crossing inside the dark space and forming an inverted image. It seems like a miracle, or a hustler's trick, but it's high school physics. The brain automatically rights the eye's image; in a regular camera a mirror flips the image.

A portable version of the camera obscura—the chamber was now a box, the hole was fitted with a lens—first became popular in the 17th century and was adapted by painters like Johannes Vermeer and Canaletto as a drawing aid. Scientists used it to observe solar eclipses, just as children do today with pinhole cameras made from shoe boxes. To capture a projected image, innovators in the early 1800s began inserting chemically treated paper or metal plates at the back of the boxy camera obscura, and the art of photography was born.

For Morell, a professor of photography, that day in the classroom was a revelation. "When I saw how these savvy, techie students were charmed and disarmed by the image on the wall, I knew this was something very potent."

His first project, conceived as a teaching aid, was to photograph the process itself. The result

Works of Abelardo Morell, a former professor at Massachusetts College of Art and Design, hang in museums worldwide. Tom O'Neill is a staff writer.

Duplicating the real thing, a ghostly upside-down image of a lightbulb appears inside a wine box converted to a pinhole camera. In his classic photograph, Morell demonstrates how a camera obscura (dark chamber) image forms.

"LIGHT BULB," 1991



was “Light Bulb” (above) from 1991. Using simple household materials, Morell illustrated the shape-shifting workings of a pinhole camera, conveying with the elegance of a Dutch still life how a photographic image forms.

Morell next set the challenge of photographing the apparition-like image that forms inside a room that’s been turned into a camera obscura. To his knowledge this had never been done before. It took months to engineer the technique, to figure out the right size of hole to allow both brightness and sharpness and to determine the right exposure time, for detail to emerge on film. Then he had to choose a room—with a view.

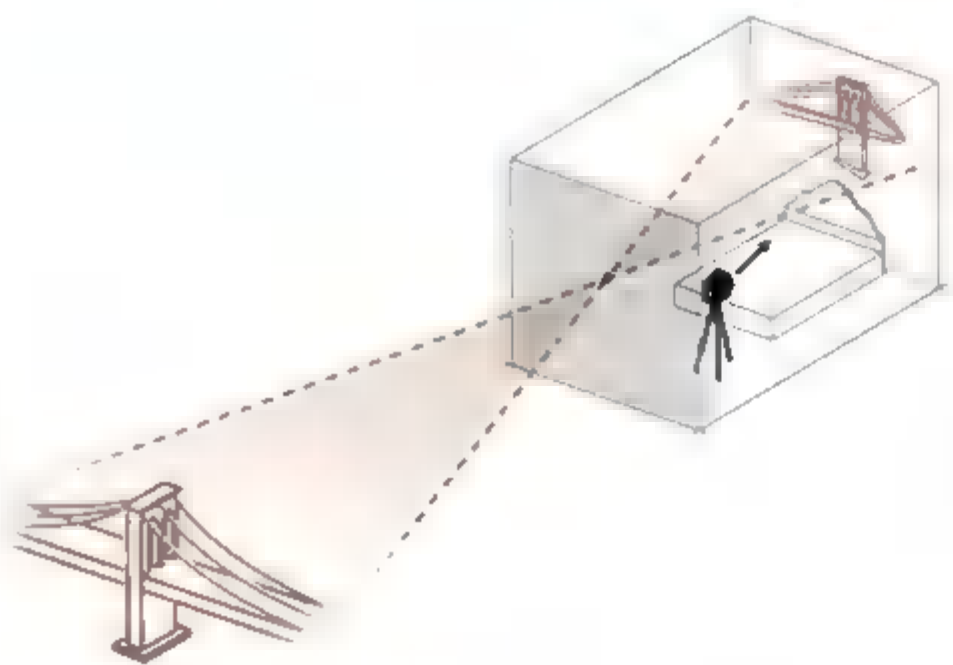
Morell’s breakthrough came in his own house in Quincy, a Boston suburb. He set his large-format view camera on a tripod in his son’s bedroom, with only a pinprick of light entering, and opened the shutter. He left the room and waited. For eight hours. The result was mesmerizing. The developed picture showed inverted trees and houses from across the street hovering over the boy’s toys like a scene from a fairy tale. “I

was giddy,” Morell said. “It felt like the moment photography was invented.”

From that eureka moment, Morell has gone on to produce with his camera obscura one of the most original and enthralling bodies of work in contemporary photography. His views range from brazen New York City panoramas to warm Italian vistas. A few years ago he switched to color, enjoying its intensity, and began turning images right-side up with a prism.

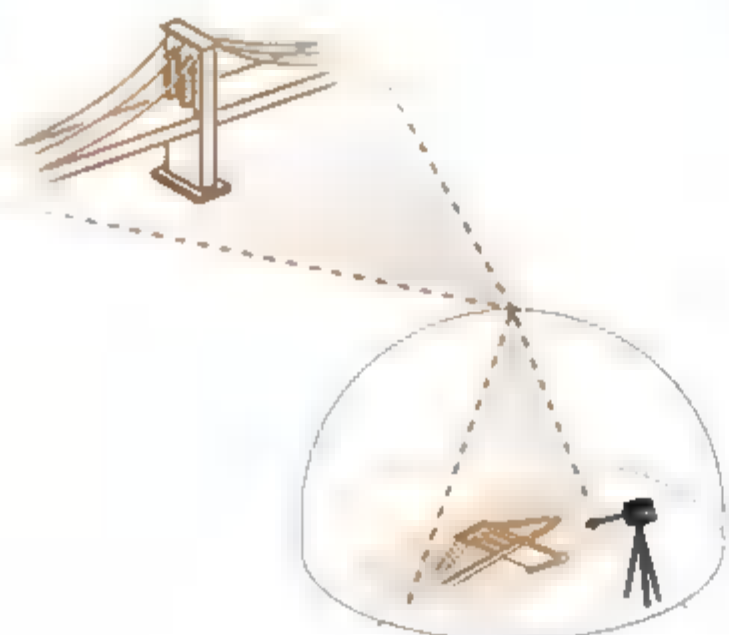
Replacing film with a digital sensor, which is more light sensitive, he cut exposure times from hours to minutes, permitting him to capture clouds, shadows, and other fleeting atmospherics. He is most excited about his work with a floorless tent, a portable camera obscura that he takes to rooftops or parks or city streets to project images directly onto the ground, giving his latest photos a rough-textured grandeur.

“I want to refresh how people see the world,” says Morell. Melting boundaries between landscape and dreamscape, his images wake up our eyes. —Tom O’Neill



As vivid as a dream, a hypersharp image of the Brooklyn Bridge and lower Manhattan materializes above tousled sheets. To make the surreal picture, Morell essentially put his camera inside a room serving as a camera and kept his shutter open for five hours to expose on film the incoming image. He used a prism to flip the projection right-side up.

"VIEW OF THE BROOKLYN BRIDGE IN BEDROOM," 2009

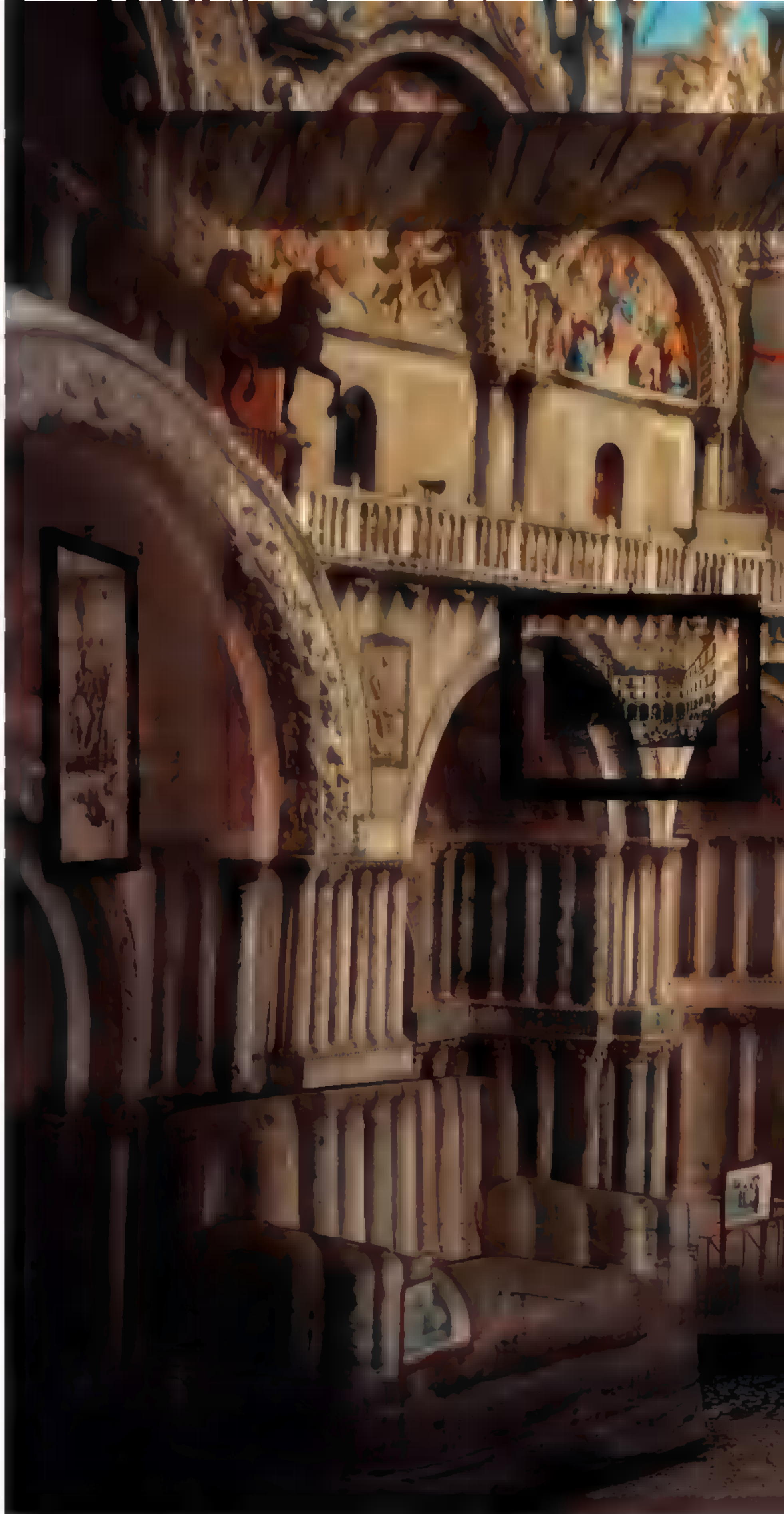


A postcard view of the Brooklyn Bridge receives
■ gritty makeover when Morell projects the image
onto a tar paper rooftop. Experimenting with
mood and texture, he turned a floorless tent into a
camera obscura. Light entering a periscope-like
opening sets an image onto the ground, providing
what Morell calls “an old-fashioned look.”

“TENT-CAMERA IMAGE ON GROUND: ROOFTOP VIEW OF THE BROOKLYN BRIDGE,” 2010

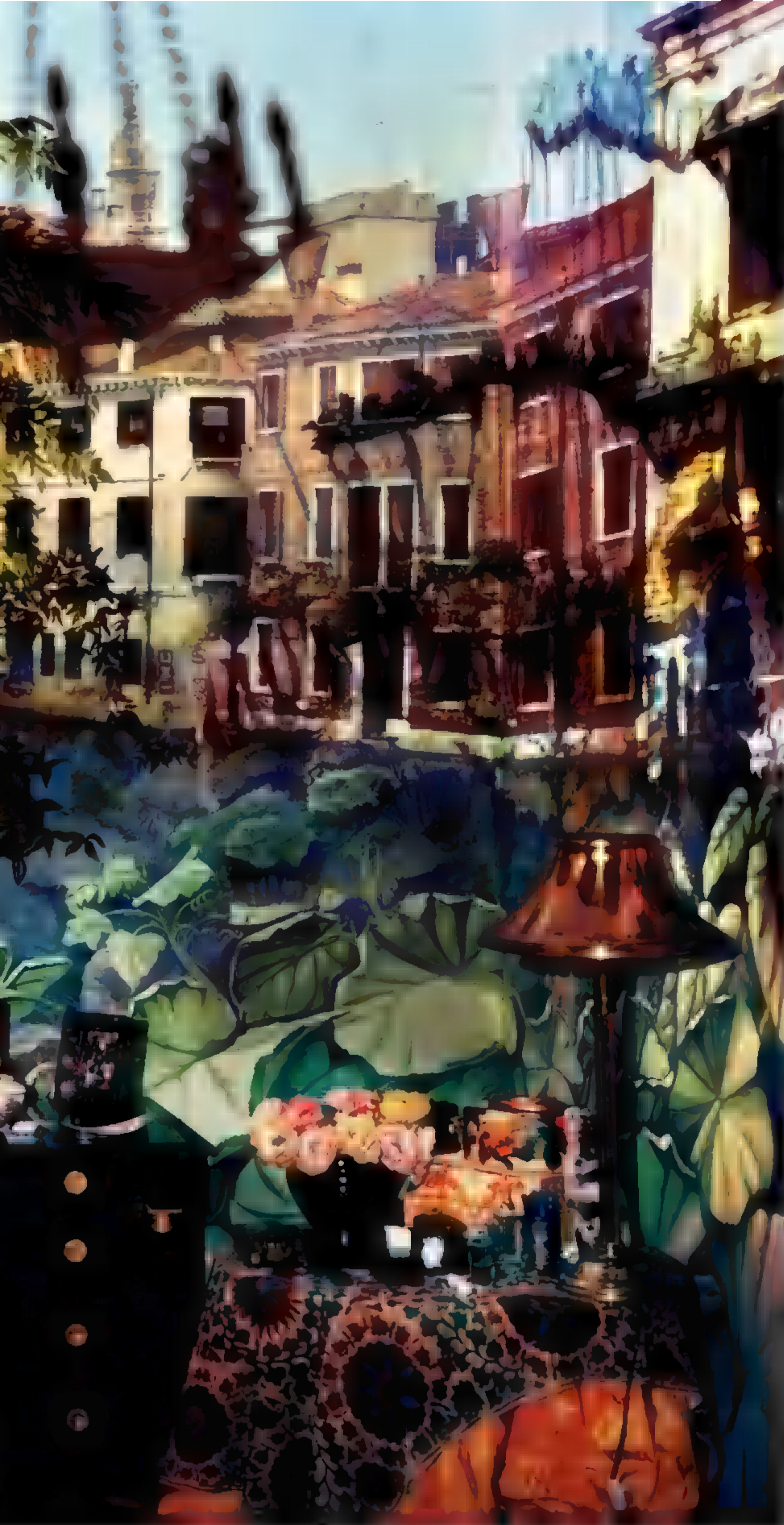
A gorgeous optical illusion, the Byzantine facade of St. Mark's Basilica ripples through a study across from the church in Venice, Italy. Here Morell winks at the 18th-century artist Canaletto, who painted a similar view with the aid of camera obscura. In the same room, Morell surmises, Canaletto projected images that he then traced on paper.

UPRIGHT IMAGE OF THE PIAZZETTA SAN MARCO LOOKING SOUTHEAST IN OFFICE, VENICE, ITALY, 2006









Colors, shapes, and perspectives run amok in a playful mind-bender devised by Morell in a Venice sitting room. "I want people to wonder, What belongs to what?" says Morell, who projected a view of the Grand Canal onto a wall painted in a jungle motif. The shadow of a chandelier adds to the image's hypnotic mayhem.

"VIEW OF VOLTA DEL CANAL IN PALAZZO ROOM PAINTED WITH JUNGLE MOTIF, VENICE, ITALY," 2008

Under the spell of camera obscura, a vista in Maine's Acadia National Park is transformed into a painterly vision when projected onto scratchy ground inside Morell's tent. "I don't invent; I capture things quite real," he says, even the tripod leg caught in ■ corner.

*TENT CAMERA IMAGE ON GROUND: VIEW OF JORDAN POND AND THE BUBBLE MOUNTAINS, ACADIA NATIONAL PARK, MAINE—MARCH, 2010







A kinkajou's pollen-dusted cheek tells of a late night nectar binge in an Ochroma, or balsa, tree.



OPEN ALL NIGHT

The balsa tree bursts into bloom at sunset during Panama's dry season, feeding a kaleidoscope of species.



Two stingless bees drowned in a sugary pool; the woolly opossum drinks around them. On one tree, 50 to 60 flowers open nightly, each pumping out almost an ounce of nectar.







A praying mantis on high alert waits for insects drawn through the night to collect Ochroma blossom pollen. Navigation lights glow in the background on the Panama Canal.

BY NATALIE ANGIER

PHOTOGRAPHS BY CHRISTIAN ZIEGLER

Club Ochroma is the bar of choice on Barro Colorado Island, and I've arrived a little early for happy hour at the Smithsonian Tropical Research Station. It's 3:45 in the afternoon, and I'm perched on a hundred-foot makeshift tower overlooking a scruffily majestic *Ochroma pyramidale* tree of about the same height. More commonly known as the balsa tree, *Ochroma* is found in many Latin American countries and is the source of the lightweight wood used to make snap-together model dinosaurs, Popsicle sticks, and Thor Heyerdahl's *Kon-Tiki* raft.

My noble specimen, however, is decidedly pre-lumber, and its branches sag with hundreds of blossoms at varying stages of ripeness: the buds that look like giant brown Q-tips, the unopened volutes with their creamy heads like swirls of soft-serve vanilla ice cream, and the mature flowers, which bloom at night and so are just now spreading wide their five fleshy petals to reveal a pollen-covered stamen surrounded by an inch-deep pool of rich, syrupy nectar. Wider, wider...

A crash of understory, a volley of *yeeps*, *coos*, and *chutterings*, and sure enough, it's the capuchins. Capuchin monkeys are famously shrewd and resourceful primates, the New World equivalent of chimpanzees. And when happy hour rolls around in Panama, you'd better believe their bellies are the first at the bar. Twenty-five of them arrive in conga lines to claim the opening rounds, the unencumbered adults and brash teenagers up front, the mothers with their clinging babies at the rear. Whatever their age or sex, the monkeys all have naked white faces, big humanlike ears, and the pursed, fretful expressions of old shopkeepers. A few stop to flash me an aggressive simian smile, but most get right down to business. They grab the edges of the ripe flowers, stick their heads inside, and with the hunched intensity of vampires, drink the flowers dry.

Natalie Angier and Christian Ziegler reported together for National Geographic's August 2009 story "The Art of Deception."

When they look up again, their muzzles are speckled with pollen, which from the tree's perspective is the whole point of its flowers: to capture the attention of a pollinator long enough that the animal can't help but be brushed with the plant's equivalent of semen, which, if all goes well, the inadvertent matchmaker will eventually deliver to the female parts of another balsa tree's flowers. The exchange is simple: You get drinks on the house, my gametes get a ride on your face.

The sun sinks, a pair of toucans passes noisily overhead, and the diurnal monkeys begin wandering off, heading back to their nests for the night. They were greedy and sloppy, but the tree is unfazed. It promptly refills pawed-over flowers with a fresh supply of nectar and nudges other blooms to unfold. *Ochroma* is just getting started.

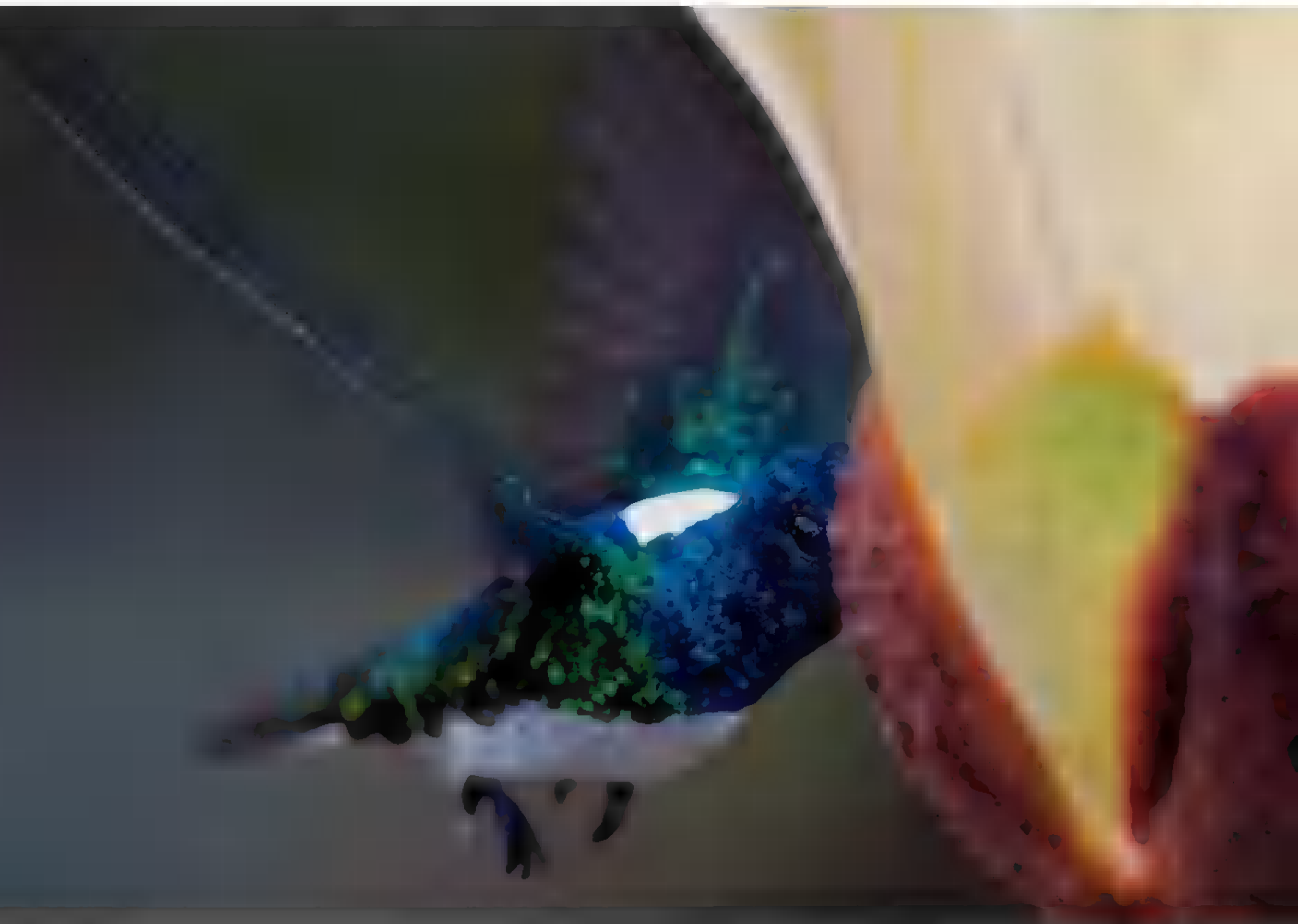
Throughout the night and into the next morning, the trees here and on the mainland nearby will play host to an unusually large and pan-Linnaean cast of characters—mammalian, avian, amphibian, insectile. A few of the customers look familiar: a close cousin of the opossum often seen bumbling around trash cans in the United States turns out to thrive in the tropics and to love the taste of *Ochroma* juice. Others are gorgeously obscure: If you were to catch



Eye to eye with his subjects a hundred feet up, photographer Christian Ziegler worked from towers he built because the trees are too fragile to climb.



White-faced capuchins, like the mother and baby above, arrive daily at their favorite trees just before nightfall. Ochroma, among the fastest growing tropical forest trees in the world, thrive from southern Mexico to Bolivia (map).



a rare glimpse of the olingo, a distant relative of the raccoon, as it slid silently through the branches like an oil spill with feet, you'd realize how alien our planet remains, how poorly we understand its parts.

Ochroma manages to attract its clientele through a simple trick of timing. It blooms at the end of the rainy season, when many other trees are lapsing into dormancy and no longer making fruit. As a result, animals that might otherwise prefer a meal of figs or nuts have little choice but to seek out the balsa tree's nectar and pollen—thin gruel by comparison, perhaps, but precious calories nonetheless. A balsa in bloom becomes the archetypal watering hole in the desert. If you pull up beside it and stay for a while, you can

watch the thirsty forest empty *Ochroma*'s pockets before your eyes.

A MEMBER OF THE MALLOW FAMILY, the *Ochroma* tree lives fast, loose, and on the edge. "It's a very early successional plant," says Joseph Wright, an ecologist at the Smithsonian Tropical Research Institute (STRI). "It comes in and establishes itself in forest clearings where other trees have fallen down or in abandoned pastures. Wherever there is new terrain, *Ochroma* is the first tall, woody plant to colonize it." The tree grows "incredibly rapidly," he says, and in 10 to 15 years it may be 50, 70, 90 feet tall. It shoots up to such dizzying heights with a shocking disregard for heft. Only the *Jacaratia*, a relative of



the papaya that is more of a treelet than a tree, has lighter wood. A chip off *Ochroma* will even outbob a cork: Balsa has a fifth the density of water, cork a fourth.

Ochroma are trailblazers and shademakers. They help form the pioneer parasols for new patches of forest, and in their understory slower, denser trees can grow at a more leisurely pace. But it's tough being an upstart, and many balsa trees don't live much past 30 or 40 years of age. They have no time to spare. They must reproduce, which is why from the age of two onward they make big, flashy flowers and infuse them with exceptionally generous portions of nectar. Over the course of a single night a flowering balsa tree may synthesize a quart or more of its

*A bright flash of emerald and blue signals the arrival of a hummingbird (left). A young boa constrictor bides its time on another bloom (above); the snake cares little for *Ochroma* nectar but wouldn't pass up a meal of hummingbird.*

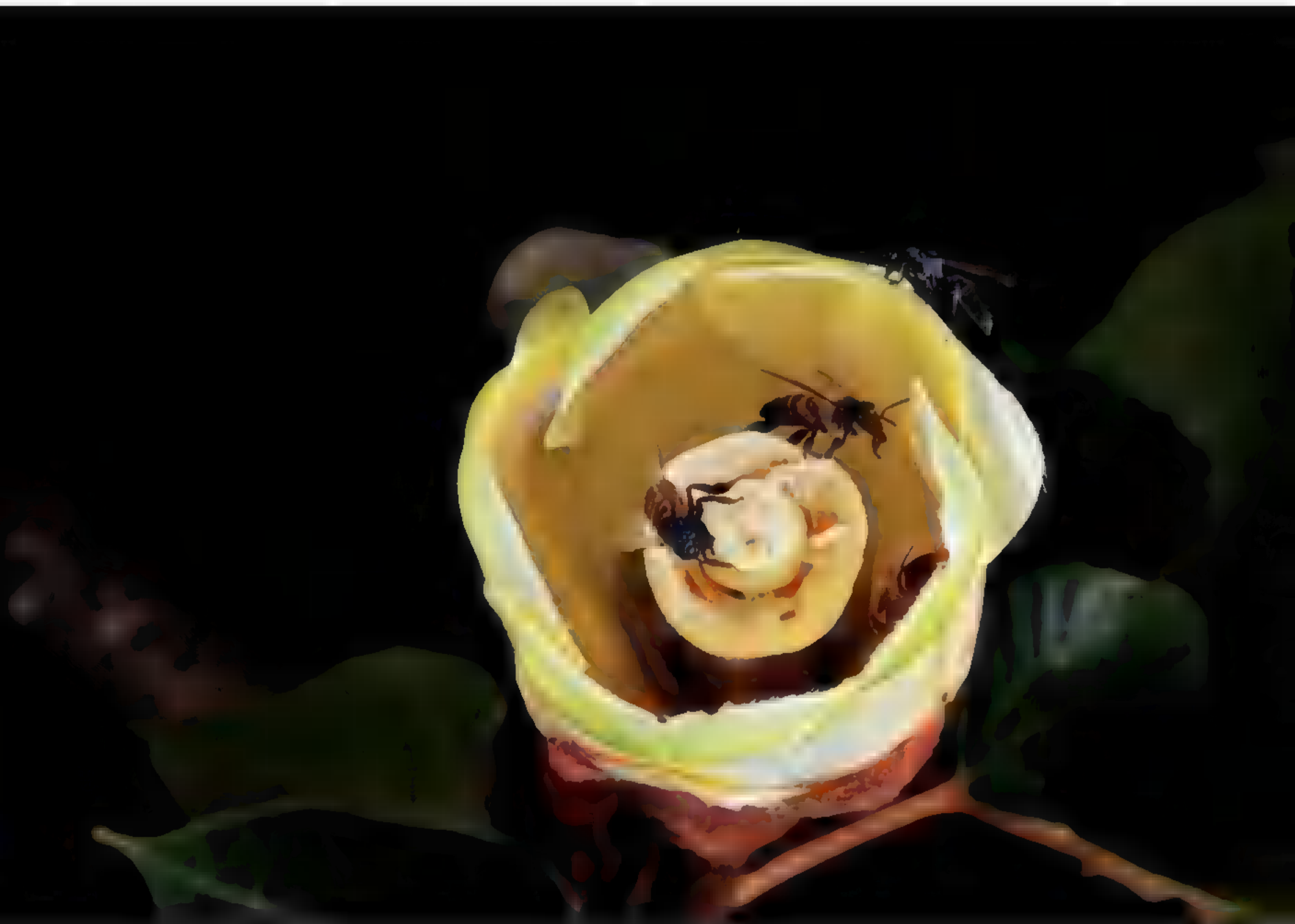
signature nectar, a complex mix of sugars and aromatic compounds that has yet to be chemically parsed but that to this casual dipper tastes approximately like sweet syrup of mushroom.

And now we come to a minor balsa mystery. Why does the tree flower at night? As a rule, trees and plants time the opening of their blossoms to attract their preferred pollinators. Day





*A greater spear-nosed bat hovers at a blossom. Bats were long considered the primary pollinators of *Ochroma*, but recent research suggests arboreal mammals do most of the work.*



bloomers are after birds, bees, butterflies, and ladybugs; night bloomers are visited by moths, crickets, katydids, and small mammals. Scientists had long assumed that the balsa tree's target audience must be bats. The supposition made sense: Bats are nocturnal, many of them are avid nectarivores, and they can easily reach the highest blooms in a tree.

Roland Kays, a researcher at STRI and the curator of mammals at the New York State Museum in Albany, is among those who now question the conventional wisdom. In tracking the animal traffic in four different balsa trees throughout the blooming season, Kays and his associates spotted only a handful of bats paying the most fleeting of visits to the flowers, even though bats

are abundant in the region and are often seen foraging diligently at other plants.

If not to attract bats, then how to explain the balsa's after-dark leanings? Nocturnal insects such as moths wouldn't need such large goblets to be lured over. Capuchin monkeys clearly appreciate *Ochroma* nectar, and they undoubtedly do their bit to help disseminate its genes, but the monkeys are thought to be incidental rather than primary pollinators of the tree. If *Ochroma* had evolved to woo the capuchin or any other daytime forager as its major pollinator, it wouldn't wait until late afternoon to start serving drinks.

Kays suspects that the tree's most consistent pollinators may be two arboreal mammals that



few have heard of and fewer still have studied: the kinkajou and the olingo. Both are distantly related to the raccoon, ringtail, and red panda, and a recent genetic analysis showed that they are only distantly related to each other.

Yet as a result of their similar life strategies, the kinkajou and olingo have evolved over time to look and act like close sister species. Both have glossy, honey brown fur that blends well with bark; long tails; and large, forward-looking eyes ideal for the visual challenge of navigating through trees at night. Only the kinkajou's tail is prehensile, like a monkey's, and only the kinkajou has been a pet for Paris Hilton. Nevertheless, the diets of the two species are nearly identical, and both are committed arborealists.

Africanized honeybees (left) circle the center of an Ochroma bloom, drinking nectar, while a black wasp lingers on a petal rim. In pale moonlight near dawn, a tiny gecko looking for bugs to eat (above) perches on a flower near the end of its one-night stand.

They're born in the trees; they eat, sleep, haggle, and tryst in the trees; they RIP in the trees. "I bet most never touch the ground in their 20 to 30 years of life," says Kays. "There's no reason to go to the ground—it's dangerous down there."

And every night in the dry season you know where to find them. □



ON ASSIGNMENT Cliff Hanger “What I’m doing in this photo is the easy part,” says Jimmy Chin (above), whose hair-raising images accompany this month’s feature on Yosemite’s most fearless climbers. “Though part of my brain is occupied with the fact that I’m hanging nearly 3,000 feet above the ground,” he explains, the biggest challenge is in the planning. From figuring out how to get to a spot in the middle of Half Dome and what equipment was needed to get there, to carrying multiple loads of gear to the top of El Capitan, the preparation for one picture often took several days and many hands. For Chin, who spent nearly seven years after college climbing around Yosemite, it was typical work—and a chance to return to his roots. “There were moments when I found myself spinning slowly on the rope, the iconic formations of Yosemite in the background. It would be so beautiful I’d almost forget to shoot.”

Jimmy Chin preps for a photo shoot near the top of Yosemite’s El Capitan.



NG Books

The People’s Pharmacy: Quick and Handy Home Remedies offers simple remedies for more than 60 common ailments. Habitual headaches or incessant acne? The cure may be as easy as opening up your cupboard (\$16.95).

Nat Geo Live Speaker Series

Hear acclaimed photographers Carol Beckwith and Angela Fisher share stories from their latest book, *Dinka: Legendary Cattle Keepers of Sudan*—the result of 30 years spent documenting the war-torn country.

WHO Carol Beckwith and Angela Fisher

WHEN May 11, 16, and 17

WHERE Washington, D.C., and Seattle, Washington. For more information, go to nglive/events.org.

Well, hello.

Introducing a new discount for
National Geographic Society members.

GEICO is known for saving people money on car insurance. And now, as a National Geographic Society member, you may qualify for an exclusive new discount on GEICO insurance. Simply get a quote today, and mention National Geographic. In just 15 minutes, you can see how much you could save.

Get a free quote.

GEICO[®]
geico.com

1-800-368-2734
or contact your local GEICO office



AUTO • HOME • RENTERS • BOAT

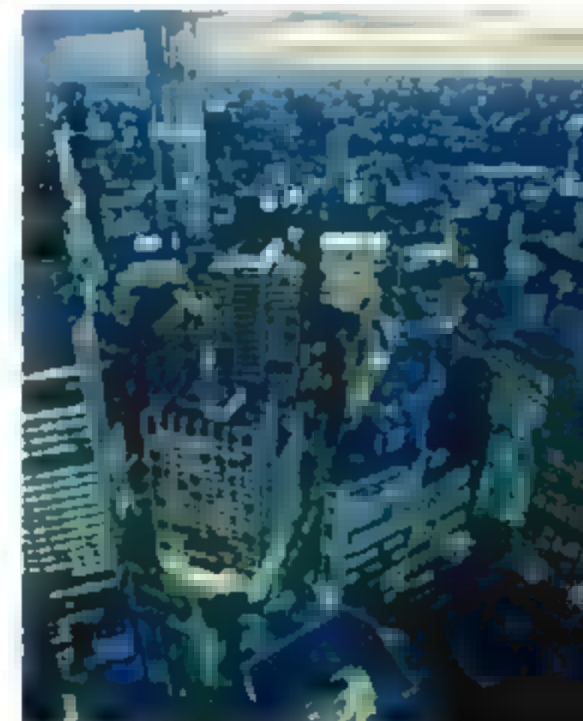
Some discounts, coverages, payment plans and features are not available in all states or all GEICO companies. Discount amount varies in some states. One group discount applicable per policy. Coverage is individual. In New York a premium reduction may be available. National Geographic Society members are comprised of subscribers to National Geographic magazine. For details on membership go to www.nationalgeographic.com/member. Homeowners, renters, and boat coverages are written through non-affiliated insurance companies and are secured through the GEICO Insurance Agency, Inc. Government Employees Insurance Co. • GEICO General Insurance Co. • GEICO Indemnity Co. • GEICO Casualty Co. These companies are subsidiaries of Berkshire Hathaway Inc. GEICO: Washington, DC 20076. GEICO Gecko image © 1999-2011. © 2011 GEICO



ASPEN ENVIRONMENT FORUM

In 2011, 7 billion people will populate the Earth.
Resources are finite. Solutions are infinite.

Join business leaders, scientists, artists, journalists, policymakers, and concerned citizens as we come together for three days of conversation and inspiration on how to address today's environmental challenges.



BE A PART OF THE DISCUSSION.

Attendance is limited to 400.

Registration is now open at aspenenvironment.org.

The Aspen Institute
Aspen, Colorado

May 30 - June 2, 2011



Give An *Inspiring* Gift



Pat Minnick included National Geographic in her financial plans.

In 2007 Pat Minnick, a professional artist, decided to establish a charitable gift annuity to support National Geographic.

"I feel good knowing that National Geographic is doing so much to protect endangered wildlife," says Pat. "The environmental problems we face are vast, but by joining with National Geographic and their history of remarkable accomplishments, I know we can pass on a more beautiful world."

Pat now receives a guaranteed life income and is a direct part of the Society's efforts to inspire people to care about the planet.

For more information about a charitable gift annuity or other ways to include National Geographic in your estate plans, please see below.

SAMPLE ANNUITY RATES FOR ONE BENEFICIARY

(Rates at other ages available upon request.)

Age 65=5.5% Age 75=6.4% Age 85=8.1%

Rates are subject to change.

Please contact us for the most current rates.

TO MAKE YOUR BEQUEST

to National Geographic, please use the following language: "To the National Geographic Society in Washington, D.C., I give _____% of my estate." Or you can name a fixed dollar amount.

CONTACT US:

Phone: (800) 226-4438

Email: plannedgiftinfo@ngs.org

Web: www.nationalgeographic.org/donate

The National Geographic Society is a 501(c)(3), tax-exempt organization.

- Yes!** Please send me information about a National Geographic charitable gift annuity!

Birthdate(s) _____

Minimum age 45. Payments begin at age 65.

Amt: \$10,000 \$50,000 \$100,000

_____ Other (Minimum gift \$10,000)

- Send me information on including National Geographic in my will.
 I have already included National Geographic in my will.

Name _____

Address _____

Phone _____

Email _____

Mail to: National Geographic Society
 Office of Estate Planning
 1145 17th Street N.W.
 Washington, D.C. 20036-4688





Three Caps Ladies of southern Silesia—a region that was part of German Prussia when this photo was acquired in 1926, though it is now located in Poland—model caps that marked a woman's marital and social status. Made of silk, the elaborately decorated bonnets and their wide, trailing ribbons were often worked with gold and silver threads, sequins, and glass beads. But fashions fade. Noted the inscription on the back of this photograph: "These beautiful Silesian caps are no longer seen except on very old women." —Margaret G. Zackowitz

👉 **Flashback Archive** Find all the photos at ngm.com.

PHOTO: H. GOETZ, NATIONAL GEOGRAPHIC STOCK

NATIONAL GEOGRAPHIC (ISSN 0027-8358) PUBLISHED MONTHLY BY THE NATIONAL GEOGRAPHIC SOCIETY, 1145 17TH ST. NW, WASHINGTON, DC 20036. ONE YEAR MEMBERSHIP: \$34.00 U.S. DELIVERY, \$38.00 TO CANADA, \$49.50 TO INTERNATIONAL ADDRESSES. SINGLE ISSUE: \$7.00 U.S. DELIVERY, \$10.00 CANADA, \$15.00 INTERNATIONAL. (ALL PRICES IN U.S. FUNDS; INCLUDES SHIPPING AND HANDLING.) PERIODICALS POSTAGE PAID AT WASHINGTON, DC, AND ADDITIONAL MAILING OFFICES. POSTMASTER: SEND ADDRESS CHANGES TO NATIONAL GEOGRAPHIC, PO BOX 63002, TAMPA, FL 33663. IN CANADA, AGREEMENT NUMBER 40063849. RETURN UNDELIVERABLE ADDRESSES TO NATIONAL GEOGRAPHIC, PO BOX 4412 STN. A, TORONTO, ONTARIO M5W 3W2. UNITED KINGDOM NEWSSTAND PRICE £4.99. REPR. EN FRANCE: EMD FRANCE SA, BP 1029, 59011 LILLE CEDEX; TEL. 320.300.302; CPPAP 0710U89037; DIRECTEUR PUBLICATION: G. TASSINARI DIR. RESP. ITALY: RAPPIMD SRL, VIA G. DA VELATE 11, 20162 MILANO; AUT. TRIB. MI 258 26/5/84 POSTE ITALIANE SPA; SPED. ABB. POST. DL 353/2003 (CONV. L. 27/02/2004 N.46) ART 1 § 1 DCB MILANO STAMPA QUAD/GRAPHICS, MARTINSBURG, WV 25401. MEMBERS: IF THE POSTAL SERVICE ALERTS US THAT YOUR MAGAZINE IS UNDELIVERABLE, WE HAVE NO FURTHER OBLIGATION UNLESS WE RECEIVE A CORRECTED ADDRESS WITHIN TWO YEARS.

PAPER because

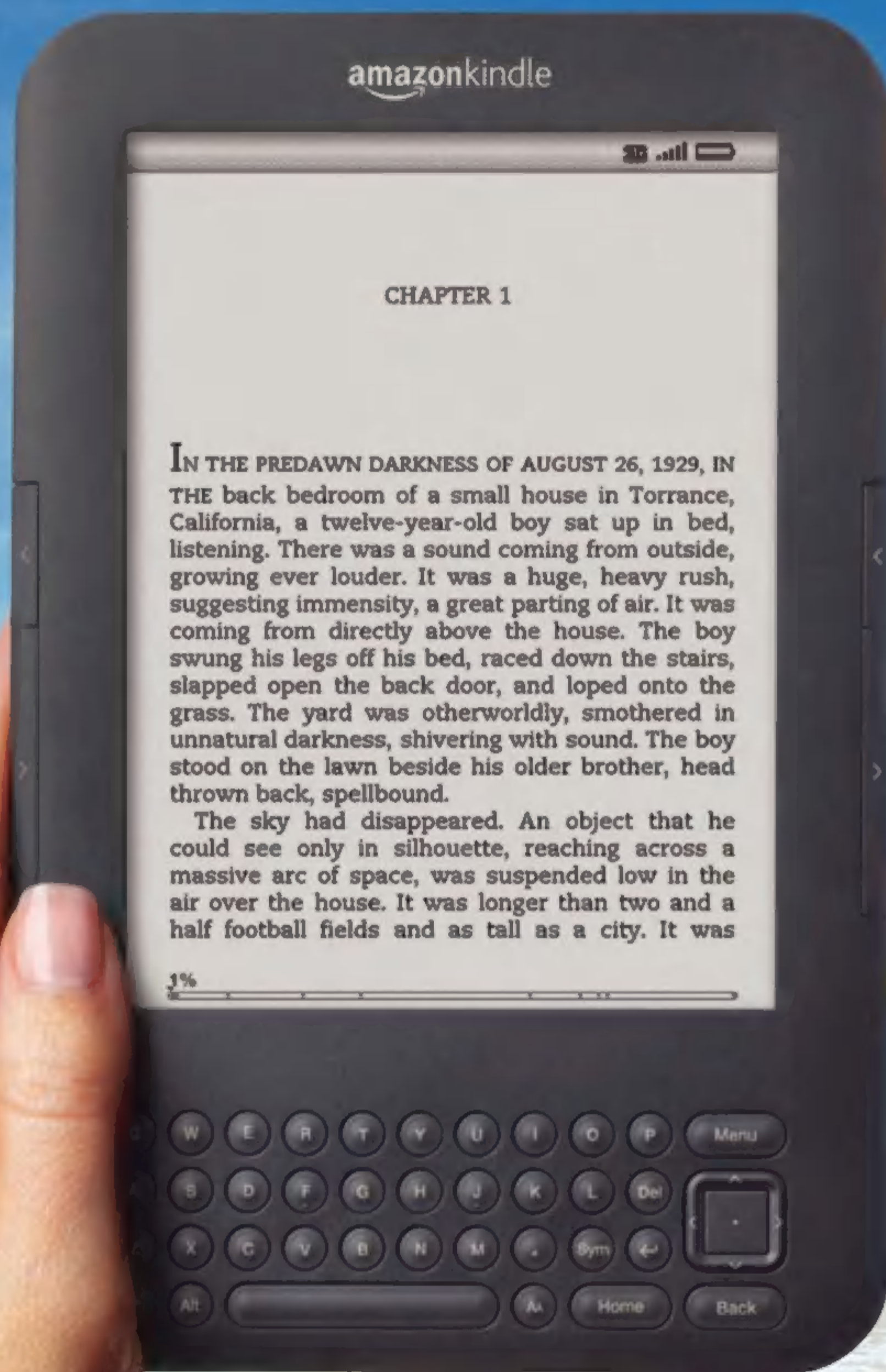
well-managed, FSC® certified forests give wildlife
more private places to “populate.”

Domtar EarthChoice® paper is certified to the standards of the
Forest Stewardship Council™ and amorous raccoons everywhere.
To learn more, please visit PAPERbecause.com.



Read to your eyes' content

High contrast E-Ink screen is easy to read even in bright sunlight



Think of a book and start reading it in 60 seconds.

Free 3G wireless on Kindle 3G. No monthly bills, no annual contracts.

Carry your library — up to 3,500 books.

8.7 ounces — lighter than a paperback.

Long battery life — up to one month.

amazonkindle

Learn more at amazon.com/kindle